CHEMICAL & METALLURGICAL ENGINEERING

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CHEMICAL & METALLURGICAL ENGINEERING

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H. C. PARMELEE, Editor

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A Development Committee For the American Chemical Society

AT ITS meeting in Birmingham 2 weeks ago the American Chemical Society took official action which, if followed to a logical conclusion, will have a profound bearing on the future development of the organization. By vote of the Council, the president is to appoint a committee of seven to consider the Society's aims and purposes, its present activities, its needs, its service to members and its general efficiency in accomplishing the objects to which it is dedicated.

This is a timely step. The A.C.S. is the last of the great national engineering and scientific bodies to take stock of its activities and determine by a careful survey how closely it is in harmony with the spirit of the times. The need is even greater because the Society has grown rapidly in numbers; and expression of the views of the membership and participation in Society functions have become increasingly difficult. In fact the bulk of the membership is probably inarticulate on most of the Society's problems. This is inevitable in some degree, but the constant effort should be to improve a society's machinery to make it more satisfactory and efficient.

What are some of the things to be considered by the development committee of the A.C.S.? First, there is the problem common to all our national bodies—a direct consequence of the length and breadth of our land—of regional representation in the directorate of the Society, based on the geographical distribution of the membership. Another problem arising from the same source is how to afford a scattered membership opportunity to participate in conventions and sectional gatherings.

A possible solution lies in discontinuing one of the two general meetings per year, either spring or fall, and substituting therefor an appropriate number of intersectional meetings in different parts of the country. This plan, combined with a generous distribution of annual meetings, would encourage participation by a larger number of members. Further, the papers for the annual meetings could then be more carefully scrutinized before acceptance, and the quality of the programs raised accordingly.

Another subject for investigation relates to grades of membership. Who is a chemist? Everyone who belongs to the A.C.S.? By no means! And yet by appropriate regulation it would be easily possible to grade membership in the A.C.S. so that the term "member" or "fellow" would be a guarantee that rigid qualifications had been complied with. No one could feel hurt if he were unable to meet the requirements, but he could take professional pride if he were able to measure up to the standard. And it would help to answer the question, "Who is a chemist?"

Other matters for consideration by the committee will arise out of the publishing activities of the society. The A.C.S. is in the publishing business in a large way. Is it satisfactory to the members? How is it managed? What does it cost? What changes or improvements are desired, if possible? The Society's finances undoubtedly will also come under the scrutiny of the committee and the membership in the interest of effecting possible economies. In short, every activity and policy of the Society will be laid open to friendly criticism if the investigation is conducted as thoroughly in the A.C.S. as it has been in the other national bodies.

It is the intention to complete the investigation within 6 months and to have the committee report at the Pittsburgh meeting next fall. This will necessitate active work in getting the views of local sections on the various questions, possibly holding open hearings in some important centers, so that recommendations can be formulated within the allotted time.

In our judgment a vast amount of good can come to the Society as a result of this action. Professional bodies, like business companies, need occasional overhauling. They get into ruts and lose the spirit of progress. Above all they fail sometimes to keep in touch with their members until dissension arises with all its undesirable and unfortunate consequences. Much of the success of the investigation will depend on the composition of the committee—a matter to which President SMITH undoubtedly will give the most careful attention. The rest will depend on the spirit in which the committee works and the extent to which the membership co-operates.

The Senate Tariff Bill

IN ANOTHER part of this issue we publish a brief review of the salient features of the Senate tariff bill. The Finance Committee's revision of the measure passed by the House last July contains many provisions of vital importance to our chemical industries. Outstanding among these is the temporary extension of the embargo on dyes and synthetic organic chemicals—an action viewed with satisfaction only by those who have been most pessimistic of the legislative situation.

Continuing the dye and chemical control act of the emergency tariff for 1 year (or 2 at the discretion of the President) doubtless offers encouragement for the resumption of manufacturing activities, but it is questionable if it is sufficient to attract the new capital necessary to round out the complete development of the dye industry. Manufacturers in a position to know tell us that in the average dye plant a complete turnover of equipment and process is necessary within a period of about 10 years. To cope with such a situation and at the same time to continue the development and exploration into new fields requires definite assurance that this work will not be wiped out in 1 or 2 years.

The dye embargo will probably meet some opposi-

tion in the Senate, but it is hoped that the favorable light thrown on the industry during the recent investigation of the Senate Judiciary Committee will react in its favor. The attitude of the farm bloc is not yet known, but announcement has recently been made that the agrarians have chosen Senator NICHOLSON of Colorado to lead their attack on the chemical and metal schedules. It will be recalled, with no little apprehension perhaps, that Senator NICHOLSON'S predecessor was the "doubting Thomas" whose tactics succeeded in defeating the Longworth bill in 1920.

Not unwelcome among the other changes in the chemical schedule is the substitution of specific duties for about thirty ad valorem rates. These are thereby removed from the field of controversy regarding the method of valuation which will be carried in the final draft of the law. The wide discretionary powers given to the President add to the uncertainty of the tariff, but if wisely used may offer a workable solution to the problems arising from changing economic conditions.

In analyzing the many provisions of the chemical schedule we have thought it desirable to offer a tabular comparison with the rates in the House bill and in the existing tariff law. The preparation of such a table entails a number of difficulties. For example, the basis for assessing ad valorem duties in the Senate bill is the same as in the act of 1913—namely, foreign market value—but it is not the American valuation plan used in the Fordney bill. Furthermore, many of the paragraphs show slight changes in phraseology, which must yet be interpreted by the customs authorities and therefore render comparisons difficult and hazardous. For these and many other reasons we are convinced that the bill itself deserves the careful study of all who are directly affected by its provisions.

Raising the Standard Of University Instruction

APPARENTLY, a certain section of the readers of technical periodicals feel that the editor knows everything—or at least knows somebody who can tell them what he doesn't know. Of course, this is a very flattering compliment, and one which tickles even a dormant vanity.

So the editor gladly tells SMITH the composition of magnalite, and obtains for JONES a few facts about the manufacture of tin oxide, or sends BROWN a list of competent chemists, with a gentle reminder that technical advice should come from consultants.

Once in a while a request arrives which excites some speculation—not so much because of the information it seeks as a wonder about just what is going on in the head of the correspondent. For instance:

"Could you send me some matter on the subject of steel, as an alloy, chiefly from the mechanical and structural viewpoint? I am to give a lecture on this subject at —— University shortly, and would be very grateful for any slight assistance. The matter need not be very extensive, as my time is limited."

Now the university which is to hear the lecture is no mean institution, and the lecturer is a man who assuredly is expert in a certain branch of philosophy. But what imp has given both the university and the lecturer the idea that he is competent to instruct anyone in "steel as an alloy," even in a limited time? Dozens of engineers who know something about steel as an alloy for machines and structures live within an hour's travel of this university, thirsty for knowledge. It would be curious to know if one of the best of them would accept a similar invitation to expound the creeds of Homoousians and Homoiousians, and then write to the editor of *Christian Science Monitor* for data.

Aluminum and Magnesium

IT IS tempting to start this essay with some hackneyed phrases like "It never rains but it pours." New alloys are being described in great number. Particularly alloys of the light metals, alloys devised and studied by the more progressive establishments which find themselves able to produce war-time supplies of aluminum, magnesium or silicon, and only disarmament conferences in the offing! If widespread popular use of these now relatively scarce metals should follow their development for army and navy, the history of heat-treated alloy steels for projectiles and armor plate would only repeat itself.

The development of uses for aluminum is well known. Shortly after its discovery it was hailed as "the coming metal," but these prophecies have yet to be fulfilled. Its white color and the fact that it needed no enamel to keep it from rusting have given it a great vogue for household utensils. Large quantities of castings are also used where lightness, durability and attractive color are desirable. It has even become a very serious competitor to copper for high-tension transmission lines—for equal duty the supporting towers can be set so much further apart and the transportation charges be so much reduced that the larger cost of aluminum per pound is often more than wiped out.

But it waited for the discovery of some method to harden and strengthen aluminum before it could be used as a structural alloy; this has been done in the alloy "duralumin" and in the new "A," "E" and "Y" alloys developed by the English during the war. Even yet such structural uses have been confined to aircraft, and perhaps will largely remain so until engineers have developed a new designing technic which will enable them to make members combining strength and lightness, the dual advantages, to a high degree and without wasting much metal. Furthermore the cost of the principal metal, aluminum, must be reduced from its present 20 cents per pound before it can successfully compete with expensive alloy steels, two or three times as strong, even if three times as heavy.

Meantime, here comes magnesium—an essential component, although in small percentages, of the hardened aluminums. It in turn is 40 per cent lighter than aluminum, and if sufficiently pure, is apparently no more susceptible to corrosion. Its price is still high, ranging about $1 per pound, but this doubtless could be considerably reduced if any large tonnage were absorbed by industry. Magnesium also is the basis of a series of well-advertised alloys called "Electron," originated in Germany, and of Mg:Al alloys developed in this country.

It needs little imagination to convince one that the surface of this metallurgical field has only been scratched. The possibilities are almost limitless. It will be developed by many men in many different places, but what they find cannot help but be of interest to any engineer who is interested in making some new or old engine serve mankind less wastefully—that is to say, to all real engineers.

A Record in Rail Production

PRODUCTION of rails 100 lb. and over per yard in 1921 was the greatest in the history of the rail industry, the output being 849,566 tons, the heaviest production of such sections previously having been 766,851 tons, in 1916. It has been more or less customary for many years past to speak of there being a "controversy" between the rail producers and the railroads, but the word is not altogether fitting. There has been a difference of aim. The railroads wanted a higher quality of rail, with little extra cost over the base price, while the rail mills favored the using of heavier sections. It would appear from the statistics of production that the rail mills have been making progress in having their contention put into practice, for the ratio of rails 100 lb. and over to rails 85 lb. and over but under 100 lb. has been steadily increasing. The 1921 production was as follows, in gross tons:

Under 50 lb.	211,568
50 to 84 lb.	214,936
85 to 99 lb.	902,748
100 lb. and over	849,566
Total	2,178,818

The total production of rails in 1921 was small. Since 1898 there have been only 2 years, 1908 and 1914, with lighter production. The record high production was made in 1906, with 3,977,887 tons. Statistics of rail production, of course, furnish no key to the manner in which track is being maintained. In 1887 and nearby years there was much building of new railroad, with heavy rail production, as well as imports. In 1906 and nearby years there was much laying of secondary track, together with particularly great replacement because old and light section rails were being destroyed rapidly by the heavier rolling stock recently introduced.

Even at the present time there is some rail wear, necessitating replacement, that will proceed more slowly in future, through rails being replaced by heavier sections. If the rails ever catch up with the rolling stock, by improvement in quality and increase in section, annual replacement requirements of the railroads will represent a relatively unimportant portion of the total steel output of the country. It is recognized, of course, that as the section is increased the tonnage required to lay a given length of track is correspondingly increased.

The industrial use of rails has been increasing steadily with the growth of industrial operations, or even more rapidly. In 1913 the production of rails 45 lb. and lighter was 470,405 tons, whereas in 1920 the production was 489,043 tons, an 81 per cent increase, while for 1921 production, naturally enough, dropped to 211,568 tons. The proportion of light or industrial rails to rails required by the regular steam roads has greatly increased.

The bessemer rail has practically disappeared. In 1907 production was 13 tons bessemer to 1 ton open-hearth. In 1911 open-hearth passed bessemer. In 1921 there was 36 tons of open-hearth to 1 ton of bessemer. In 1912-13 a total of about 6,000 tons of electric rails was produced, for experimental purposes, while there has been practically no such production since then. The alloy-treated rails, which ran about 150,000 tons in both 1911 and 1912, have almost disappeared. Doubtless there is a connection between these facts and the increased vogue of rails 100 lb. and over in section.

The Spring Meeting In Birmingham

BIRMINGHAM is a considerable distance away from most other places—except Shelby County, Alabama, where the rigors of the Volstead act are modified with "corn." When the Alabama Section urged the American Chemical Society to be its guest for the 1922 spring meeting the state was full of chemists, and Muscle Shoals, which is a certain Irish twist in the Tennessee River, was getting ready to do something, and there were any number of willing hands there to help things along. But hard times can make great changes, and the curious illusion that qualifies American business in chemistry has also spread over Alabama. There, just as with us here in the North, merchants who have "bought into" chemistry regard research and scientific control as the first luxuries which, under pressure of hard times, a corporation should rid itself of. So there were very few Alabama chemists available at the time of the meeting, although those few did yeoman's service in looking out for the three hundred and fifty-odd registrants.

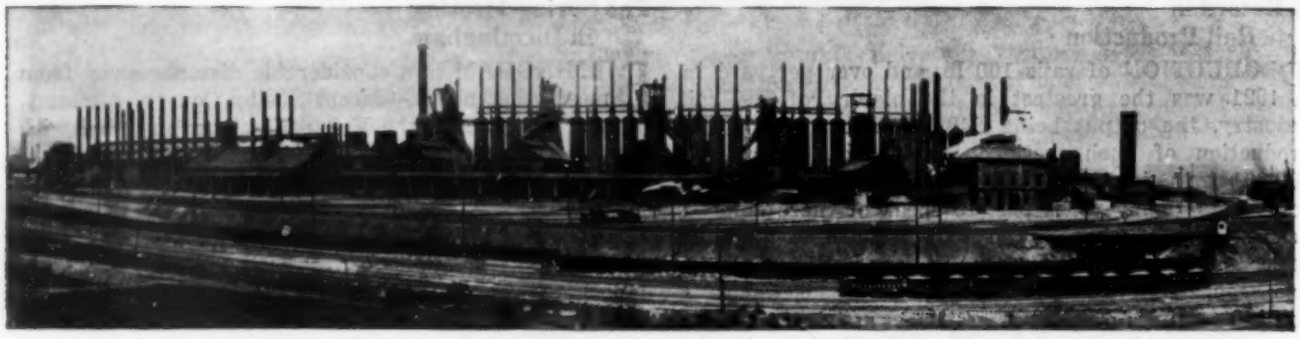
The effect of such a meeting on the city of Birmingham and environs would be hard to tell. Probably it is slight. But the enthusiasm of the men at the meeting was very great. They get closer acquainted when there are not so many, and the discussions are more informal and intimate. We doubt if the Educational Section has ever had so illuminating a meeting. This was in part because Dr. SMITH presided, and his presence is always a guaranty of the best kind of company. Then again, the subjects were well chosen, and the participants felt themselves pretty well acquainted.

Very important was the symposium on distillation which opened the meetings of the Division of Industrial and Engineering Chemistry. Organic chemistry has grown into a division of importance. It was always numerically rich in papers, but in later years some of the papers have proved to be very interesting. The Petroleum Section, soon to be dignified as a Division of the Society, maintained the high standards set in its two previous meetings at Rochester and New York. Rubber, cellulose, physical and inorganic, sugar, dye, water—in fact all the branches of chemistry represented at the divisional and sectional meetings—report encouraging progress and many noteworthy contributions.

H. G. Wells on Modern Alchemy

YOU can usually find something of interest in H. G. WELLS' books if you persevere and read far enough! After writing about half a million words on History, Mr. WELLS freshens up—possibly after a cheering session at tea and muffins, and jots down the following thoughts, only too true:

"As scientific men tell us continually, and as 'practical' men still refuse to learn, it is only when knowledge is sought for her own sake that she gives rich and unexpected gifts in any abundance to her servants. The world of today is still much more disposed to spend money on technical research than on pure science. Half the men in our scientific laboratories still dream of patents and secret processes. We live today largely in the age of alchemists, for all our sneers at their memory. The 'business man' of today still thinks of research as a sort of alchemy."



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Birmingham Meeting, American Chemical Society

Report of the Sixty-third Meeting, April 3-7, 1922—Council Meeting—Addresses at General Sessions—Abstracts of Papers Presented at the Industrial, Physical and Inorganic, Rubber, Sugar, Dye and Water Divisions and at Educational, Historic, Cellulose and Petroleum Sections

BIRMINGHAM, Iron City of the South, threw wide her gates on April 3 to 7 for the convening of the sixty-third meeting of the American Chemical Society. In point of attendance the spring meeting fell short of most of the Society's recent gatherings, for less than 400 members were registered, but this loss in numbers was more than compensated by the better opportunities for developing acquaintanceships and stimulating good fellowship. Southern hospitality was seen at its best. The local committees, the members of the Alabama Section, the industries and the generous-hearted citizens of the Birmingham district did much to make the excursion into the Southland one of the most memorable in the history of the Society.

The Council Meeting

The Council met at 4 p.m. at the Southern Club, with President Smith in the chair. He believed the past year had been one of progress in building up a better understanding of what chemistry means in the public mind. There is, however, still a great deal to be done and he urged on members of the Society the need constantly to expound the relations of chemistry to progress.

The Society has had an annual deficit to meet for 3 years past, so that the directors, in order to avoid loading it with debt, had planned for certain restrictions in expenditure. These consisted in refusing the additional quotas asked for and needed by the editors of *Abstracts* and the *Journal*, in cutting down the appropriation for the *Industrial Journal*, and in omitting the publication of the formula index. They did this with great regret, but sound financing made it necessary to limit the budget to their means. President Smith then called upon Secretary Parsons to read a letter from President F. P. Garvan of the Chemical Foundation in which he advised that that corporation would make good any deficit of the Society up to $25,000, in order to avoid the retrenchments decided upon, to the end that the progress of chemistry in America may not be inhibited for lack of proper information. The thanks of the Society were voted to the Foundation, to President Garvan, and also to Messrs. Parsons and Howe for negotiating the gift.

The Priestley committee made its report and asked to be discharged. A portrait has been provided and funds for a medal are in hand. President Smith, as chairman of the committee, showed a replica of the medal in bronze, and we take pleasure in saying that it was designed by an artist, and that the die provides for a medallion which is beautiful in appearance. This is a consummation devoutly to be wished, inasmuch as other greatly sought prizes in chemistry are nothing more than sculptured whisker exhibits in gold with names in raised letters. The Priestley medal is to be given once in 3 years for distinguished services in chemistry, and the committee of award is to consist of the president, the last past president, the secretary and the treasurer of the Society, and the editors of its journals. Dr. Smith was thanked for his splendid work as chairman of the committee.

Note was made of the passage of the patent bill, and the Society was congratulated on the fact.

The charges brought against American chemical industry have been well threshed out before an investigating committee in Washington, and the industry completely vindicated.

The scientific monographs are a complete success, and the technological monographs are coming along with equal promise of merit. The outlook for these works, both in pure science and in technology, is very favorable.

The deaths of Giacomo Ciamician, honorary member, and of Charles Baskerville were duly recorded and proper resolutions were spread upon the minutes.

It was voted that the Council of the Society urge the publishers of chemical books to adopt a uniform practice of printing the date of the writing or revision of every work issued. For lack of such regularity questions of priority often are held in abeyance.

The Cellulose and Petroleum Sections asked to be made regular divisions of the Society, and it was voted that they formulate bylaws and submit these for approval at the Pittsburgh meeting in September.

In order to establish regularity in the organization of divisions it was voted that 3 years shall elapse after the formation of a Section before it may become a Division.

New local sections were authorized at the Hawaiian Islands and at Sacramento, Cal., and, subject to the waiver of the Pittsburgh Section, one for northern West Virginia at Morgantown was authorized.

Next Spring Meeting in New Haven

The invitation of the New Haven Section and the Corporation of Yale University to meet at New Haven in the spring of 1923 was accepted.

Although it may not be voted on more than 1 year in advance, Dr. Smith advised that Philadelphia was planning for a great sesquicentennial exposition in 1926, and that the Philadelphia Section was urgent in the hope that the Society would meet there at that time.

Prof. William McPherson was elected director to succeed Major H. E. Howe, who, on assuming editorship of the *Industrial Journal*, became ex-officio a member of the board.

The felicitations of the Council were extended to Prof. Henry Clay White on the completion of his 50 years of service at the University of Georgia.

It was voted that the Council bear in mind that when eminent contributions are made for research or to further the advancement of chemistry, they be duly acknowledged and recorded at its meetings. The munificence of George F. Baker in building the laboratory at Cornell was a case in point.

In regard to the selection of alternates for local councilors it was ordered that the manner of selection be left to the respective Sections, but that individual councilors shall not have the power to name their own proxies.

Beginning Jan. 1, 1923, the name of the *Journal of Industrial and Engineering Chemistry* is to be changed to *Industrial and Engineering Chemistry*.

In order to consider lines of activity and measures of reconstruction that may be desirable for the Society, including a possible distinction between professional and non-professional members, it was voted that the president appoint a committee of seven to report at the Pittsburgh meeting.

It was also voted that the intersectional meetings be encouraged and that the Society approve of them.

The meeting concluded, after a dinner tendered by the Alabama Section, with reports of the various committees. In regard to maintaining an employment bureau, the sense of the meeting was that, while the Society should not undertake it, the maintenance of such a bureau by the Chemists Club or by a separate corporation be encouraged.

The General Meetings

The first general meeting was opened in the ballroom of Hotel Tutwiler on Tuesday at 10 a.m. by J. F. Carle, chairman of the local executive committee. After expressing the pleasure of the local section in having the Society meet with them, Mr. Carle introduced Nathan L. Miller, Lieutenant Governor of Alabama, who welcomed the visitors in behalf of his state. He spoke of the natural resources of Alabama which could not have been developed without the aid of the chemical profession. In referring to the water-power possibilities at Muscle Shoals recently brought to the attention of the entire country, Governor Miller said: "Whether the Ford offer is accepted or rejected, one thing must be said to his credit, and that is that by his offer he has saved this wonderful development from the junk pile. Wherever cheap power is, there is manufacturing and where there is manufacturing a great field is offered for the chemist."

W. E. Dickson, City Commissioner, was next introduced by Mr. Carle, and extended the welcome of the city of Birmingham in behalf of the municipal government. President Smith thanked the distinguished hosts in the name of the American Chemical Society, and continuing in his characteristic and delightful manner, he reviewed chemistry's recent contributions to the health, happiness and prosperity of the country. Deprecating the strife which has grown up recently between the so-called "pure" and "impure" branches of science, Dr. Smith urged a united effort in demonstrating the relation of chemistry to the welfare of the general public.

A resolution of respect to the memory of Prof. Charles Baskerville was read by Ellwood Hendrick and unanimously approved by the assembly. Similar resolutions were introduced by Prof. W. A. Noyes in observance of the death of the following eminent contributors to the science of chemistry: Giacomo Ciamician of Bologna, Italy, Adolph von Bayer of Bavaria, and Emil Fischer of Berlin.

Development of Forest Product Industries in the South

Problems confronting the forest product industries of the South were outlined in a comprehensive manner by Carlile P. Winslow, director, Forest Products Laboratory, Madison, Wis.

Enormous original timber resources in this part of the country have been developed in the past 30 years to an extent which has given direct support to from 30 to 75 per cent of the working population of the different states. However, the peak of production has been passed and a decrease to less than half the present output may be expected within the next 15 or 20 years. Since conditions in the South are more favorable to the rapid and cheap growth of timber than in any other part of the United States, immediate reforestation should relieve the situation and prevent the development of a crisis.

The practical solution to the future timber supply lies largely in definitely showing that the growing of timber is profitable. This can be accomplished to a large degree by well-directed and progressive research to determine how to utilize existing wastes and how to produce at a profit the products and byproducts existing and available in the raw material. Mr. Winslow devoted a major part of his paper to the possibilities for development in naval stores, turpentine and rosin production by steam distillation and extraction from chips, destructive distillation of hard and soft woods, newsprint paper from resinous woods, ethyl alcohol from wood waste, hydrolyzed sawdust for cattle feed, wood preservation. The elimination of waste by the use of dimension stock cutting in the secondary wood-using industries and by careful use of wood for boxes and containers was also emphasized.

Industrial Development of the South

William H. Stone, Associate Editor, *Manufacturers Record*, presented an inspiring address on "The Remarkable Development of the South and Its Relation to the American Chemical Industry." He illustrated the progress of the South since 1880 by comparing it with what the South was accomplishing prior to 1860 and what conditions were for 20 years preceding the Civil

War. Prior to 1860 the South was rapidly outstripping New England and the Middle States in its total per capita wealth, production of agricultural products, railroad construction and manufacturing. After the Civil War, however, the South was in desperate financial and industrial straits until about 1880, when recovery began. Mr. Stone quoted numerous statistics from the "Blue Book of Southern Progress" to show developments in the Southern States since 1880, particularly in the growth of population, capital invested in manufactures, production of pig iron, bank deposits, and in the production of various non-metallic mineral products. For nearly all of these, the 1919 figure is double or more than double the corresponding figure for the entire United States in 1880 and in some instances is equal to the country's production in the census years of 1900 and 1910. These figures show clearly that the South has not been a laggard in the utilization of her natural resources. In concluding his address, Mr. Stone quoted several eminent chemical authorities to show that the South has great potentialities for the development of a chemical industry.

Manufacture of Phosphoric Acid in the Electric Furnace

The first paper at the afternoon session on Tuesday was delivered by Theodore Swann of Birmingham, who discussed the manufacture of phosphoric acid in the electric furnace. Mr. Swann, who is president of the Federal Phosphorus Co., described that company's operations at Anniston, Ala., where an electric furnace plant of eight furnaces with a total transformer capacity of 20,000 kw. is now in use. Electric power is supplied by the Alabama Power Co. from its hydroelectric plant on the Coosa River and is delivered to the furnaces at 44,000 volts.

The process consists in charging a mixture of phosphate rock, coke, sand and iron borings into an electric furnace and smelting to liberate the phosphorus. A ferrophosphorus, analyzing 24 to 25 per cent of phosphorus, is tapped off. Such phosphorus as is not absorbed by the iron is carried off in the furnace gases and oxidized by the air to P_2O_5. The furnace gases and phosphorus fume are then blown through a condensing apparatus and an electrical precipitator, where a strong phosphoric acid, containing as much as 90 per cent H_3PO_4, is collected. The iron in this product is said to be about 0.06 per cent and the As_2O_3 content 0.02 per cent.

A concentrated fertilizer using a high strength liquid phosphoric acid (62 per cent P_2O_5) to produce ammonium phosphate offers a promising possibility for this process. By adding potash to this compound a fertilizer containing three to five times as much plant food as the ordinary fertilizers is obtained. The development of such a product is of course dependent on its intelligent use by the farmer.

Petroleum Research

"There is urgent need of a promoting and co-ordinating agency to foster general petroleum research of a fundamental character, the results of which can be used by all those engaged in the development of the industry." So declared Dr. Van H. Manning, director of research of the American Petroleum Institute, in his address on "The Pioneer's Field in Petroleum Research." Although investigations and research of the highest order are being conducted in governmental, educational and industrial laboratories, this has been largely at the expense of unnecessary duplication of effort and of financial loss. The increasing necessity for greater efficiency and economy in the production and utilization of petroleum is a responsibility resting heavily upon the shoulders of American chemists.

Dr. Manning described his present paper as the first gun in a campaign to bring the problems of the chemist and of the industry to the attention of the corporations and others who are in a position to endow the undertaking of such a comprehensive research program. As indicative of the character and scope of the work which should be undertaken, a list of approximately seventy problems of the petroleum industry has been compiled by Dr. Manning and mimeographed copies were distributed to all who were interested in petroleum research. Many of the problems presented are too large for any single individual or institution to cope with unaided; others are so great as to require the collective resources of the nation's educational, governmental and industrial research departments; still others may require the establishment of entirely new research facilities.

This research program, which later was indorsed by the Section of Petroleum Chemistry, may be said to represent a broad picture of the future work which must be done in the production, transportation, refining, marketing and utilization of petroleum and its products.

Recent Developments in Chemistry of Rubber

A very clear résumé of recent work in rubber chemistry was given by Dr. W. C. Geer.

Crude rubber is apparently formed in certain glands of the rubber tree and put into the latex in the form of solid particles about 0.0005 mm. in diameter, so that 1 c.c. would contain about 50,000,000. The latex averages about 28 per cent rubber hydrocarbon, 60 per cent water, the remainder being resins, proteins and mineral matter. The proteins exert a protective action on the colloidal particles which varies among different species. Bacterial action upon the proteins starts immediately in the fresh latex, so that the coagulation must be carried out without delay.

Coagulation may be effected in various ways, but there is a decided need for a thorough chemical study of the whole subject. After washing, the soft dough or coagulum produced by the action of acetic acid on latex contains about 92 to 94 per cent of rubber hydrocarbon.

Dr. Geer emphasized the declining importance of wild rubber and predicted that it would soon practically disappear. He said that London was the financial center, Singapore the shipping center and Akron the manufacturing center of the industry.

One reasonably reliable means of determining the botanical origin of rubber is the acetone soluble, as determined by analysis. It is not, however, a guide to the quality of vulcanized rubber.

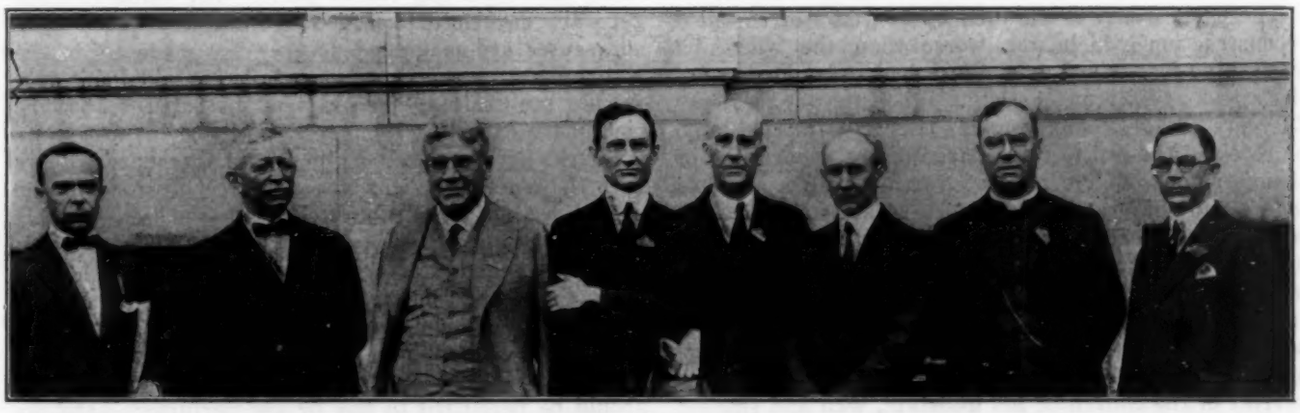
Brief reference was made to the importance of studies on the diffusion of gases through crude and vulcanized rubber. A rubber mixture in which poison gases are insoluble would be very desirable.

Much work has been done in recent years on the chemistry of vulcanization. It used to be thought that sulphur vulcanization did not take place until the melting point of sulphur had been reached, but it is now recognized that vulcanization is a function of time as

well as temperature, so that the amount of sulphur combined is proportional to the time at constant temperature. With 3 per cent of sulphur, a soft rubber is obtained, no compound between rubber and sulphur being formed. With excess sulphur, combination takes place up to 32 per cent, but the only compound formed is the monosulphide. As yet the mechanism of vulcanization is not well understood and it is not possible to remove the sulphur and get the rubber back.

Organic accelerators increase the turnover and have beneficial effect upon many of the properties. In this connection credit should be given to the Diamond Rubber Co. for pioneer work. In 1906, George Oenslager experimented with aniline as accelerator and in June, 1907, A. H. Marks used thiocarbanilide. Some modern accelerators are so powerful that the mixture will vulcanize over night at room temperatures.

In the case of fillers, particles of large size are not as strength-giving as smaller ones. The use of carbon black and zinc oxide is based not only upon fineness but also upon some other factor, probably interfacial tension or specific adhesion to rubber. Contrary to a common impression, fillers have a definite use and some of them cost more than the crude rubber, so that they are certainly not added to cheapen the mixture. The service test is the final judge of any mixture and the phenomenon of aging is receiving careful attention.



Carlile P. Winslow, Edgar F. Smith, Ellwood Hendrick, H. C. Parmelee, R. B. Moore, W. D. Collins, Rev. Father Coyle, W. H. Stone

In conclusion, Dr. Geer indicated the future of the industry and stated that the developments in the chemistry of rubber have resulted in improvements in the industry.

Research for the Canners

Problems of the canning industry which require research begin with the planting of suitable seeds and extend to the shipping, storage and spoilage of canned goods on the shelf of the merchant. Dr. W. D. Bigelow, director of the Research Laboratory of the National Canners' Association, discussed these problems broadly, with special emphasis on the importance and scope of those still awaiting solution. Food poisons and food values, including vitamines, both need attention, but the urgent industrial questions relate to processing of the canned goods to prevent spoilage. The three major and interrelated studies of Dr. Bigelow's laboratory are: (*a*) Determination of thermal death point of spoilage bacteria; (*b*) rates of heat penetration into foods during cooking or sterilization; and (*c*) effect of acidity (p_H number) on bacterial life.

The major troubles of the food canner are involved in spoilage or deterioration. By studies of experimental packing of food under actual factory conditions, the effect of various factors has been determined, among them preheating before sealing, exhaustion of air from the cans, life of typical spoilage bacteria, etc. Hydrogen sulphide, residual free oxygen in the pack, excessive treatment of hominy with lye and other causes of food discoloration are also important problems as yet unsolved.

No accurate basis for evaluating tin plate for can-making is known. The steel base, according to some authorities, should have carbon, silicon and sulphur respectively less than 0.2, 0.025 and 0.1 per cent and phosphorus between 0.05 and 0.1 per cent. But little is known as to the effect of extending the rolling time, annealing, methods of rolling, effectiveness of pickling or method of tinning. Usual practice demands open-hearth base for can ends, but bessemer steel is used for the bodies of the cans. The perforation of cans by fruit acids still remains a big problem and one not likely to be settled until more sound metallurgical research has been completed on these questions.

Informational Needs in Science and Technology

The circumstances leading to the organization of the Research Information Service of the National Research Council and the ambitious plans of that division for the cataloging and dissemination of scientific information was the basis of the address "Informational Needs in Science and Technology" by Charles L. Reese, chemical director of E. I. du Pont de Nemours & Co. Much time is lost and work is duplicated because of the fact that the tremendous fund of man's previous experience and knowledge is not conveniently available. The war emphasized the need for some central clearing house for scientific information and many individual attempts were made to organize such bureaus. Most of these have been abandoned because of economic pressure, although some are struggling to achieve self-support and profit. Dr. Reese expressed the belief that a general informational clearing house should be an endowed public service organization independent of the need of self-support or of gain.

As an example of the importance of classified information in connection with research, the speaker cited the information bureau of "das Königlische Materialprüfungsamt," which claims to be able to answer 80 per cent of the problems put up to it supposedly demanding experimental research.

The Research Information Service of the Research Council has been available for 3 years. Foremost

among the principles of policy are the desirability of developing a general clearing house for scientific information rather than a depository of knowledge, the conduct of free informational service for the promotion of research and the development of complete co-ordinated machinery for gathering, classifying and disseminating information.

It is proposed to extend this service eventually to an international scope, embracing the entirety of human knowledge.

Chemistry in the Old South and the New

Dr. F. P. Venable, past president of the Society, spoke on "Chemistry in the Old South and the New." He pointed out Charleston, S. C., as vying with Philadelphia in scientific inquiry during Colonial days, and he gave a short sketch of Prof. Emmet of the University of Virginia and of his distinguished pupil J. Lawrence Smith, who was later U. S. Commissioner to Turkey to aid that government in the development of Turkish mineral resources and in the growing of cotton. He also told of the work of Prof. Mallet, his own guide and mentor, of his atomic weight determinations, his production of ordnance for the Confederacy during the Civil War, his work on zirconium in which he proved Berzelius to be in error in his conclusions; his long professorship of industrial chemistry at the University of Virginia, and his many contributions to science.

The Civil War was followed by 10 years of so-called reconstruction which was worse than the war, and everything was wiped out. Work had to be done under the stress of extreme poverty. When the speaker was 23 years of age, completing his education in Germany, he received the call to take charge of the department of chemistry at the University of North Carolina. He had indeed full charge of it, inasmuch as his only assistant was a negro preacher. The laboratory was a cellar, now used for coal storage. The water supply came from a hogshead and their force pump was operated by this same darkey preacher-motor-power; and it was irregular. Iron sulphide was made at a blacksmith's forge and the work had the unexpected effect of instigating a revival in the church of his assistant, who had smelled the fumes of fire and brimstone, and with this experience he was inspired to lead sinners to the anxious seat and to rescue them as brands from the burning.

The university was closed during reconstruction days, and when it opened its income from all sources was $10,000 a year. Half of its alumni had been lost in the war. Today it has 2,000 students, an annual income of $750,000, and last year the Legislature appropriated $2,000,000 for new buildings and equipments.

He related many experiences and concluded with the statement that generally speaking in institutions of learning of the South, both state and private, the sciences are receiving important consideration. On the other hand, there is much need for more research. Many of those in control of these institutions oppose research as not within their scope, and this is an error which should be corrected. He said also that those in charge of Southern industries must awaken to the fact that this is a new world, and that they must be guided by science if they would prosper.

The Public Meeting

At the public meeting held in the auditorium of Hotel Tutwiler on Wednesday evening, Prof. Marston T. Bogert of Columbia University, past president of the Society, delivered an address on "The Flower Fields and the Organic Chemist. Perfumes, Natural and Synthetic." He outlined the very slight knowledge that we possess of this Cinderella of the senses, and indicated the belief that olfactory phenomena are of a chemical nature. He gave Boni's scale of three groups of odors, Zwaardemker's nine primary odors, and Henning's "smell prism" of six. He brought out the theory of correspondence between various odors and notes on the muscial scale, and he recalled Henning's dictum that we recoil from certain odors through the association of fear rather than from unpleasant sensations produced in the nose. He recalled the tradition that "over-indulgence in smell among a people is said to characterize a period of moral decadence." We are disposed to doubt this, however, and to attribute the dictum to the early Christian fathers, who were instigated by the anchorites to the belief that the world was straightway coming to an end, and that smelling was sinful because of its sex associations.

His talk was replete with miscellaneous information. For instance he said that 1 part in 8,000,000 of musk may be easily detected, but that so may 1 part in 10,000,000 of vanilla. Butyl mercaptan is noticeable in dilutions of 1 part in 460,000,000, and he said there are soil odors recognizable in even greater dilutions.

The Ainus of North Japan track their enemies by scent, just as a dog tracks game. The sense is more generally developed in men than in women. And since our senses are magnified as they are made to do the work of others that have been lost, he said Paris perfumers are training men blinded in battle to become perfumery experts.

Sharks have an olfactory organ 12 ft. square. Bears hate the smell of musk, but are especially fond of the odor of asafœtida. Bedbugs follow up the scent of their victims in seeking prey. Ants have a curiously combined tactile and olfactory organ which enables them to sense shape and odor at once. They know the age of one another by this means.

In Athens a popular place of meeting was at the perfumers' shops. Solon prepared a law that only men should be permitted to buy or use perfumery—and we should like to read the discussion that followed. The Arabs were formerly the great perfumers of the world, and they supplied Greece and Rome in the days of their respective greatness.

The lecture was followed by lantern slides showing the perfumery industry of France.

Division of Industrial and Engineering Chemistry

A short business meeting preceded the reading of papers before the Division of Industrial and Engineering Chemistry. A letter from Prof. J. R. Withrow recommended that no concerted action be taken by the American Chemical Society on the A.S.T.M. specifications for lime. P. H. Walker presented a report from the committee on methods of analysis and specifications for soap and soap powder, A. H. Campbell, chairman, representing the results of 4 or 5 years' work. It was adopted. H. E. Howe said that the committee on oils and fats, W. D. Richardson, chairman, was active and that a progress report would undoubtedly be ready for the Pittsburgh meeting. W. D. Collins reported progress for the committee on standardization. The gas chemists expressed a desire to hold a section meeting at Pittsburgh.

The feature of the technical program was a sympo-

sium on distillation, the fourth of a series of symposia. Plans for the program were upset in several cases, however, by the refusal of employers to permit the presentation of purely fundamental data. Automatic heat control was suggested as the topic for a symposium at Pittsburgh. Prof. R. E. Wilson felt that it should be extended to include all methods for process control.

Symposium on Distillation

Efficiency and Capacity of Fractionating Columns

Two viewpoints were taken in considering the efficiency and capacity of fractionating columns—the theoretical and the practical.

Prof. W. K. Lewis took up the theoretical phase and showed how it was possible to modify Sorel's mathematical treatment so that computation is simplified and graphical presentation of results is possible. As in Sorel's method, the enrichment from plate to plate was determined by equating the energy and material input and output, assuming that equilibrium was reached between the vapors and the liquid through which they bubbled.

Although the equations are applicable generally, they were developed for specific mixture, alcohol-water, in order to facilitate presentation. Considering a column in continuous operation with the feed entering at the middle of the column, the following equation was derived for the rate of enrichment or the rectification between any plate n above the feed and the next higher plate, $n + 1$:

$$\frac{dx}{dn} = k\left[(y_n - x_n) - \frac{V_c}{O_{n+1}}(y_c - y_n)\right]$$

where:

$\frac{dx}{dn}$ = rate of increase in concentration of liquid per plate.

k = fractionation efficiency of tower and plates; ratio of plates theoretically required to actual requirement.

y_n = mol fraction of more volatile component in vapor.

x_n = mol fraction of more volatile component in liquid.

V_c = mols of distillate produced per unit time.

O_{n+1} = mols of overflow from plate $n + 1$ to n.

y_c = mol fraction of more volatile component in the distillate produced.

Assuming perfect rectification, the equations developed were used to calculate the theoretical minimum number of plates required for a given rectification, by combining them with experimentally determined relation between x and y for mixtures under consideration. The result is an integral which may be evaluated graphically.

These equations were checked against experimental data on alcohol-water and hydrocarbon mixtures and found to agree satisfactorily.

As a further demonstration of the applicability of these equations, a practical problem was worked out—that of continuously rectifying a 10 per cent alcohol solution to produce a 94.5 per cent product and leave only 0.1 per cent in the waste. Factors to be determined were overflow or heat consumption, height of column or number of plates, point at which feed should be introduced. Plotting the results of the calculations indicated the following solutions to the problems:

The minimum overflow for rectification was found to be 3 mol per mol of product. When the influence of the amount of overflow per unit of distillate upon the number of plates required was considered, it was again apparent that an overflow of at least 3:1 was necessary. At this ratio an indefinite number of plates would be required as the curve became almost parallel to the axis. At an overflow of 4:1, 67 plates would be necesary; at 6:1, 36 plates, while at 20:1, 25 plates would suffice. Beyond this point there was no further appreciable drop, as the curve became parallel to the other axis. An economic balance between the cost of a column and the cost of heat to operate it can be struck from such a curve.

The feed should enter the column on that plate at which the enrichment curves for the bottom and the top of the column intersect. The author stated that so far as he knew this was the first method for determining the point at which the feed should enter. It would seem that in commercial practice the feed is often introduced too high up in the column.

H. E. Howe, W. Lee Lewis, Charles L. Reese, Van H. Manning, J. E. Teeple, William McPherson, Francis P. Venable, M. H. Ittner, B. R. Tunison

W. A. Peters, Jr., chairman of the symposium, explained how Prof. Lewis' method had been applied to plate columns of both sieve and bubbler cap type and to packed columns. It was found more convenient to use an arithmetical equation based upon Prof. Lewis' differential equation and also to use latent heat fractions instead of mol fractions. The relation existing between the compositions of the vapor rising from one plate, the liquid refluxing from the plate above and the heat balance in the theoretical column is given by the equation

$$X_{n+1} = \frac{y_n - y_c(1-\rho)}{\rho}$$

X_{n+1} being the equivalent latent heat fraction of the light boiling material in the liquid on the $n + 1$ plate; y_n the equivalent latent heat fraction of the light boiling material in the vapor rising from the nth plate; y_c the equivalent latent heat fraction of the light boiling material in the distillate; ρ the ratio of the heat required to volatilize the liquid run back divided by the total latent heat in the vapor passing up through any horizontal cross-section of the column. Equivalent latent

heat fraction is a term used to designate the heat required to volatilize the amount of light boiling material in 1 lb. of the mixture on or above the given plate divided by the latent heat required to volatilize 1 lb. of this mixture.

From this it is apparent that when ρ, y_c and y_n are known, X_{n+1} can be determined, which fixes the value of y_{n+1}, so that liquid and vapor composition at any point in the theoretical column may be determined.

Comparison between actual and theoretical columns may be made by determining ρ, y_n and y_c from a run on a given mixture and calculating the theoretical column which will give the same values for y_n and y_c with the same value for ρ. The number of plates calculated divided by the number actually required gives the efficiency factor, k, of the actual column. For filled columns divide by the height of the filled column. It was found more convenient to use the reciprocal of this efficiency, called the height of equivalent theoretical plate, *H.E.T.P.*

This method was first applied to a 28-in. sieve plate column with twenty-eight plates separating acetic acid and water, the distillate containing 98.52 per cent water and the liquid on the top plate 98.14 per cent water.

LOCAL COMMITTEE

Left to Right—A. G. Overton, J. T. MacKenzie, J. P. Montgomery, F. W. McMeans, J. R. Harris, R. W. Allen, J. F. Carle, M. Kuniansky, A. K. Boor and T. Swann.

Calculating one theoretical plate at a time, the fifteenth plate was found to give a liquid containing 98.1 per cent water and a vapor with 98.6 per cent. Thus fifteen theoretical plates will do the work of twenty-eight in the sieve plate column, so that the average efficiency k is $15 \div 28 = 0.536$.

Tests with alcohol-water mixtures in a standard 36-in. Badger bubbler cap plate column gave a value of 0.70 for k when less than 90 per cent alcohol by weight was contained in the mixture.

In order to account for the increased efficiency, two tests were made in the same bubbler cap plate column. k was found to be 0.45 for acetic acid-water and 0.694 for the alcohol-water, showing that there is a marked difference in the efficiency of the same column for different mixtures, although there is no difference between plate columns of either type under comparable conditions of immersion and size of perforations.

In the case of packed columns the efficiency was found to vary inversely as the diameter of the packing, while even greater divergence was noted between the efficiency for different mixtures than in the case of the plate columns.

The increased efficiency of packed columns when small packing is used is offset somewhat by the cost of the smaller fillings. In determining the cost it is necessary to consider the capacity factor, which for practical design purposes may be measured by the maximum vapor velocity which a given column will stand without priming. Small hollow cylinders make an ideal filling material and the author announced that his company had patented a method for making ½- to ⅜-in. hollow cylinders at an estimated cost of about $30 per cu.ft., which is in sharp contrast to the figure of $250 per cu.ft. quoted by a London firm for ½-in. rings patented by Dr. R. Lessing and described in *J. Soc. Chem. Ind.*, 1921, vol 40, pp. 115-119.

Assuming the lower figure for the small rings, a comparison was made between the cost of a cast-iron bubbler cap plate column and a column packed with ½-in. cylinders, each to be equivalent to fourteen theoretical plates and to deliver 41 gal. of 92.5 per cent alcohol per hour with an average value of 0.8 for ρ. From the data for maximum vapor velocity, the diameter of the plate column must be 24 in. and of the packed column 18 in. The height will be twenty plates and 4.7 ft., respectively. A cast-iron column of this size actually cost $1,300 in 1919, but could probably be made now for $1,000. The cost for the packed column was estimated as $365. In the case of acetic acid-water separations the cost of the packed column was not found to be much lower ($1,200, against $1,350), but the life should be much longer.

A valuable feature of this method is that it makes possible direct comparisons between laboratory and plant fractionating columns, so that a large column can be designed to make any desired separation which has been made in a laboratory column.

Plate Efficiency of a Continuous Alcohol Still

A paper by Clark S. Robinson on the plate efficiency of a continuous alcohol still was summarized by Prof. W. K. Lewis. Three tests on an alcohol column gave widely varying plate efficiencies, ranging from 24 to 56 per cent. In discussion it was pointed out that in most of the earlier data on this subject either the heat consumption or the concentrations on the plates was omitted.

Simple Distillation of Hydrocarbon Mixtures

Prof. W. K. Lewis presented the results of work done with C. S. Robinson on the simple distillation of hydrocarbon mixtures. Gasoline is a mixture of hydrocarbons whose boiling points range from 50 to 200 deg. C. The usual test is an Engler distillation. The refiner would like to know what his plant results are going to be from such a laboratory distillation. Prof. Lewis found that with a mixture of 65 per cent benzene and 35 per cent toluene the curve for simple distillation calculated from Raoult's law checked the Engler curve within 1 deg. except near the end of the curve. This deviation was found to be due to rectification which could be eliminated by slightly superheating the still head. This method may be applied to gasoline.

Benzene Purification

A very thorough discussion of the steps involved in the purification of benzene from absorption in straw oil was given by S. S. Heide. The crude is first fractionated to give 70 per cent of 90 per cent crude benzene, 13.5 per cent of 90 per cent crude toluene, 4.5

per cent each of crude light solvent and crude heavy solvent and a residue containing 5 per cent wash oil and 2.5 per cent naphthalene. The working up of each fraction was then considered in detail.

Wood Turpentine

C. A. Lambert described the production of wood turpentine from stumps, downwood or slabs by steam distillation. A charge of 14 tons gives 112 gal. of crude wood turpentine, which upon refining gives 60 per cent pure wood turpentine and 40 per cent pine oil. The physical properties of each 5 per cent fraction were presented in tabular form.

Calculation of Heats of Vaporization

There being no adequate data on heat of vaporization of liquids, Prof. W. K. Lewis and Harold C. Weber pointed out the possibility of calculating these from Hildebrandt's modification of Trouton's rule and from vapor pressure curves.

Glycerine Distillation

Recent developments in distillation systems for the production of dynamite and chemically pure glycerine were outlined by J. W. Bodman. Steam for the spray in the still is supplied by the sweet-water evaporator which is made a part of the unit under vacuum. By means of suitable heat exchangers over 90 per cent is recovered directly as dynamite glycerine as compared with 75 per cent under the older systems. In addition to this and the reduced steam consumption, floor space is economized.

General Papers

Whitewashes and Alkaline Paints

Investigations carried out in the research laboratory of the National Lime Association on whitewashes and aqueous lime paints were summarized by Dr. G. J. Fink.

Of the siccatives used, those such as casein, which with lime form insoluble films, proved to be the best, while those which are water-soluble, such as glues, are not so satisfactory for exteriors. Several alkaline salts were used for accelerating the solution of casein, trisodium phosphate proving to be the most satisfactory. Among the addition agents used with lime in mixtures containing no definite siccative alum and table salt were effective in improving the workability and permanence of the whitewashes. Several formulas developed and tested were shown to be superior to most of those in common use.

Discontinuous Extraction Processes

L. F. Hawley made a study of Turrentine's kelp char extraction process (*J. Ind. Eng. Chem.*, 1921, vol. 13, p. 605), according to the theory of discontinuous extraction formerly developed (*J. Ind. Eng. Chem.*, 1917, vol. 9, p. 866). By using Turrentine's data in the mathematical theory of the process it is shown that the incomplete extraction is due to the fact that complete solution of the potassium chloride was not obtained in the first treatment of the raw material. The other conditions of extraction were so efficient that the final recovery was only slightly less than the theoretically perfect recovery with the solvent ratio and number of treatments employed in the process.

In answering the question, "Can We Afford to Make Potash in America?" R. Norris Shreve reviewed conditions in the domestic industry and drew up a balance sheet of debits and credits to show the necessity for tariff protection.

Fuels, Engineering and Chemistry

Eight of the papers of this Division dealt with problems of fuels chemistry or fuels engineering and formed virtually a second symposium. A. C. Fieldner and G. W. Jones, of the Bureau of Mines, presented further results on their studies of internal combustion engines, discussing particularly "carburetor adjustment by gas analysis." The relation of the pounds of air per pound of gasoline varies widely with commercial service station adjustments. The results of road trials on various cars shows that about 13.5 lb. of air per pound of gasoline burned is the average ratio for maximum power; 15 lb. for theoretical complete combustion; and about 17 lb. for maximum efficiency (miles per gallon). The carbon dioxide percentage in the exhaust which corresponds to these several air-gas ratios is definite. For example, 12 per cent CO_2 in the exhaust is equivalent to a carburetor adjustment for maximum power. An ordinary adjustment corresponds to about 70 per cent completion of combustion on the average, whereas a good carburetor adjustment easily reaches 85 per cent combustion.

With some carburetors, adjustment by methods of analysis at one rate of operation permits good operation at other rates. Such carburetors are regarded as properly designed. Other carburetors have the reverse direction of trend in curve with change in rate of operation and consequently cannot be accurately adjusted for all rates of use. Using the method of gas analysis on the exhaust as the basis of adjustment, these investigators have found generally that 20 to 60 per cent increase in mileage per gallon is easily attained. Methods for sampling of exhaust gases and for adjustment of carburetors on the road are described fully.

Classification and Analysis of Coal

S. W. Parr, of the University of Illinois, proposed in his first paper a new classification of coal based upon its heating value per unit of coal substance and the per cent of volatile matter contained. Former methods of classification were based largely upon the ratio of the volatile matter to the fixed carbon of the coal. Parr proposes to determine the unit heat value of coal substance by subtracting from the total B.t.u. 5,000 times the percentage of sulphur and dividing the remainder by 1 minus the sum of 1.08 times the ash plus 0.55 times the sulplur. This gives a true heat value for the coal substance itself without regard to the percentage of the ash or sulphur contained.

A large number of data were presented to show that wide variation in the heat value of coal substance would be found on identical coal by the ordinary method of calculation. The variation with different ash or sulphur content on coal from the same seam or mine is usually 125 to 250 B.t.u. and sometimes reaches 1,100 B.t.u. But the Parr formula calculated on different samples from the same seam or mine invariably gives agreement within the limits of experimental error for the heat value determination. The discrepancy between clean and dirty fractions from coal washing were usually less than 50 B.t.u., in only one or two cases reaching 80 B.t.u. The results are so accurate that it is possible to detect by this means the county within the State of Illinois from which coal comes or to identify the seam from which it comes. In other words, this method gives a significant characteristic of any particular type of coal independent of the variation of ash or sulphur in

the particular sample examined. This is true not only for mid-continent coals but also for samples from South Africa, Brazil, West Virginia and other bituminous coal territory and also for cannel coals, sub-bituminous and anthracite.

Parr proposes a chart using the heating value per unit of coal substance as one co-ordinate and the volatile percentage as the other. This classification groups the coals as follows:

	Heating Value Per Lb. of Coal Substance
1. Brown lignite	11,500-12,500
2. Black lignite	12,500-13,500
3. Sub-bituminous	13,500-14,000
4. Western bituminous	14,000-15,000
5. Eastern bituminous	15,000-16,000
6. Anthracite	15,500-16,000

Thus it is noticeable that on the basis of heat value alone the lignites and younger bituminous coals are differentiated sharply, but the actual percentage of volatile enters to distinguish between coals of similar heat value but of different percentage of volatile ranging in the order anthracite, semi-anthracite, low volatile bituminous (Pocohontas type), Eastern bituminous and cannel coal, all of which have about the same heat value per unit of pure coal.

Parr also reported on a method for the ultimate analysis of coal by use of sodium peroxide fusions. He considers this method quite good enough for engineering work and particularly important where calculation of stock losses is desired. The calculation determines the hydrogen content of the coal by subtracting from the total heat the heat from the carbon (8,080 calories per gram), and that from the sulphur (2,777 calories per gram), and dividing the remainder by 24,450 (the heat value of hydrogen in calories per gram). Calculation is also made on the assumption that the nitrogen in the coal is 1.25 per cent (a figure quite generally applicable), and thus a determination of oxygen in the coal is possible by subtracting from 100 the sum of the percentages of carbon, sulphur, hydrogen and nitrogen. In discussing this paper by Parr, W. K. Lewis and A. C. Fieldner outlined briefly other crude engineering methods for similar calculation of ultimate analysis.

Heat Value Of Wood

A third report by Parr gave data on the heating value of wood as follows: Oak, 8,550 B.t.u. per pound; pine, 8,836; birch, 8,458. These three woods when thoroughly air-dried contain moisture removable at 105 deg. C., as follows: Oak, 8.35 per cent; pine, 8.88 per cent; and birch, 10.18 per cent.

Melting Point Of Coal Ash

A. C. Fieldner, W. L. Selvig and W. L. Parker, of the Bureau of Mines, Pittsburgh laboratories, reported on comparisons of the standard gas furnace and micropyrometer methods for determining the fusibility of coal ash. In the air the micropyrometer method does not agree at all well with the gas furnace method, but when used with a reducing atmosphere about the sample the agreement is good for ash samples melting not higher than 2,600 deg. F. With samples melting above this point the micropyrometer method gives distinctly different results than the furnace method. In the case of the micro method, the vitrification or fusing of fine edges of the ash particles is observed. In the case of the furnace method using cones, it is the slagging of the mass as a whole which is observed. On chain grates coals which slag are objectionable. With underfed stokers only vitrification of ash substance is sufficient to give trouble. Therefore for the two types of furnace use the two methods of laboratory determination may be correspondingly significant. However, as yet this practical feature of the work has not been settled. In the investigation the Bureau of Mines has had the co-operation of the Bureau of Standards, the New York Consolidated Gas Co., the United Gas Improvement Co., and others. In these co-operative tests it has been found that the micro methods check to about the same extent in most cases as do the furnace methods—that is, ranging over about 100 deg. F. between different laboratories. The same man working with one apparatus usually finds variation of not over 40 deg. F. between tests on the same sample.

Coke Properties And Use

H. J. Rose, of the Koppers Co. laboratory, Pittsburgh, presented a paper on the determination of specific gravity of coke. He points out that the fineness of grinding is important. He recommends water as the wetting medium with 200-mesh coal boiled for 30 minutes. His results are not yet definite as to whether or not a vacuum must be used to get complete wetting in the pores.

S. P. Kinney and G. St. J. Perrott, of the Bureau of Mines, Tuscaloosa Station, reported preliminarily on "The Shatter and Friability Tests for Metallurgical Coke." The general conclusion which these investigators have reached is that friability-test results are of no meaning whatsoever. Results of the shatter test are of little greater significance. The average deviation of tests on the same coke, even though made as carefully as possible, will be several per cent. Hence it is altogether impractical to use this test as a guide for oven operation. Results were presented on work done by all of the customary methods, including the drop test, the bag test, the revolving drum method, etc.

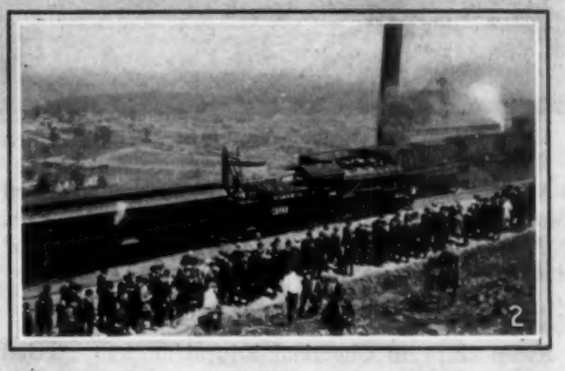
G. St. J. Perrott and H. W. Clark reported very fully on the results of their investigation in Salt Lake City, where they participated in the Bureau of Mines' study of the smoke problem of that community. Their results on coking of Utah coals have already been published in Chem. & Met. In this report they developed somewhat further the estimate of cost of coke and of the market for byproducts in that territory. Their figures indicate that it will be impractical for a coke plant to be established in Salt Lake City of sufficient size to meet the need for smokeless fuel if coke is to be substituted for bituminous coal generally. The market for byproducts in that territory is wholly inadequate to absorb at a favorable figure the output of a plant of that size.

Section of History of Chemistry

The Section of History of Chemistry has a good start, and so long as Drs. Edgar F. Smith and C. A. Browne are in the saddle, the Section is sure to thrive. Dr. Smith presented a sketch of Dr. Thomas Cooper, an Englishman by birth, a brilliant student at Oxford, but so radical in his views and so outspoken and insistent in his opinions that waves of trouble were always rolling about him. He was a jurist and served as Circuit Judge in Pennsylvania, he practiced medicine successfully, and was finally appointed to the chair of chemistry at South Carolina State College at Columbia. Dr. Browne harked back to early references to chemical warfare, while Father Coyle of Holy Cross College, Worcester, Mass., told a thrilling list of the achievements of a Jesuit priest

A. C. S. Birmingham, 1922

The T.C.I. Special and Visit to Muscle Shoals



1. Arriving at the byproduct plant of T. C., I. & R.R. Co.
2. Arrival at Iskooda Mine, No. 14.
3. The barbecue at Bayview.
4. Close-up of the barbecue.
5. Arrival at the blast-furnace plant of T. C., I. & R.R. Co.
6. The all-day party at Sheffield.
7. Inspecting Wilson Dam.
8. Crossing the construction bridge at Wilson Dam.

BYPRODUCT COKE OVENS, TENNESSEE COAL, IRON & RAILROAD CO.

named Anastasius Kirchen who lived 1602-1680, invented the magic lantern as an incident, but who was in effect one of the fathers of modern chemistry. A number of other interesting papers were presented.

Section of Chemical Education

The Symposium on Chemical Education was carried on under the chairmanship of President Smith, and it proceeded without a dull minute. The papers had to do with high school and first year college chemistry and the training of chemical engineers. In teaching high school chemistry, for instance, the question was raised whether it was not better to begin with metals and more tangible things than with gases and the difficulties of the gas laws to young minds. It seemed to resolve itself into the conclusion that the first thing to accomplish is to arouse the interest and curiosity of the pupils—and when this is accomplished the rest is easy.

What to do with high school chemistry in college was a harder question. In some colleges preliminary teaching of the subject is not recognized, and in others freshmen are divided into those who have had chemistry and those who have not, but this does not always work out well. Many who have "had chemistry" and even passed their examinations don't know anything after all, while others are well prepared. It was a hard nut to crack. At one university they have two classes scheduled for the same hour, and at the end of the first month many who have entered the more advanced class drop back into that which is elementary. But even that is not satisfactory, and the problem seems not yet solved.

There was considerable discussion on what the function of the first year's course in chemistry is, whether formative or informative. Father Coyle of Holy Cross College, Worcester, Mass., believed that the study of chemistry develops character. But the question would not down as to whether the first year of chemistry belongs properly in the secondary school or in college.

The "Project Method" of Teaching Chemistry

Prof. Gordon of the University of Maryland outlined a very interesting "project method" for teaching chemistry. This consists in re-writing the book, leaving out whatever may be easily discovered. It brings the classroom into complete co-ordination with the laboratory, for what is left out in the book and discussed in the classroom becomes the subject for study in the next laboratory period. The vacant spaces are filled in by the students, and the books are checked up before they are taken out of the laboratory. In the first half hour of the class following the laboratory period there is a quiz on what has been done, and a correction of all errors made, while the latter half of the hour outlines again work which is to be completed in the laboratory. It works well with about 400 students, on a basis of 2 hours lecture and quiz to 3 hours laboratory. It challenges the students to think, and they get credit for their thinking.

In the afternoon session the Massachusetts Institute of Technology plan was outlined, in which students spend a fifth year in industries, and there followed a general discussion, with papers interspersed, of chemical engineers.

Industrial Chemists Wanted

It seemed generally agreed that in 4 years' time it is impossible to train a good chemist and a good mechanical engineer at once. Either the chemistry or the mechanics must suffer. It was suggested that what is wanted is industrial chemists, and not mechanical engineers with a smattering of chemistry. In response to the question of what a chemical engineer should be, credentials offered by applications for positions were quoted, in which, in very defective English, the applicants had shown their studies of chemistry, physics and mathematics to be in the ratio of 12 to 1 to 1½. In other words, they had "boned up" on chemistry and did not know anything else. What to do with those roughnecks in professional life seemed another unsolved problem. Somebody proposed that applicants for positions be required to send moving pictures of themselves at table, and phonograph records of their colloquial discourse.

Teaching Methods in Vogue Elsewhere

Prof. Bogert of Columbia described methods in vogue at Columbia and Prof. Charles W. Evans circulated a series of charts which he had found very helpful in teaching organic chemistry. Lively discussion was elicited by Prof. H. A. Webb of Teachers' College, Columbia University, who presented a paper on "Standard Tests in Science, Especially Chemistry." These were drawn up on the basis of "mental tests." They show up the unpreparedness of students in an amazing manner, and enable the authorities to weed out much earlier in the process than otherwise those who cannot learn. By standardizing they make marking easy: the professor's secretary can do it by means of a key, whereas if tests are not standard there are scarcely two instructors who mark alike. Against the system is its somewhat mechanical nature of treating all students alike when they are individually different, and the fact that its whole merit is lost if advance copies of the questions get around. But a number of professors seemed to feel that a great advance had been made in the art of examining, and that these new standard examination papers should be warmly welcomed.

Prof. J. P. Montgomery of the University of Alabama told of his plans for chemistry courses, and Prof. Edward G. Mahin of Purdue presented a paper on "Science or Athletics?" It doesn't take much imagination to picture the plight of a professor of science who is trying to lead his students along into the paths of

wisdom, and to compare the piffling unimportance of his message with that of the cheer leader. It was a sad paper, that viewed the matter with alarm, but it found such favor among the auditors that the author was urged to have it published. Somebody suggested that it wasn't athletics that dragged students down as much as the quality of the young men themselves that could not reach up. But that was not a popular view.

The foregoing is a record of impressions rather than a detailed report of the meeting. Dr. Smith's frequent and illuminating comments and anecdotes made it really a memorable occasion; and if we had the space we would gladly tell more. If nothing definite was accomplished, it was, nevertheless, full of leads and in this respect it was said by a number of those present that, for their own purposes, it was the best meeting ever.

Section of Petroleum Chemistry

The Petroleum Section, first organized a year ago at the Rochester meeting, is one of the youngest sections to become a Division of the Society. This authorization, recently approved by the Council, is to take effect at the Pittsburgh meeting in September, 1922. The encouraging progress made as a section speaks well for the future success of the new Division of Petroleum Chemistry.

In the absence of Chairman T. G. Delbridge, Vice-Chairman D. K. French of Chicago presided at the two sessions on Wednesday, April 5, during which a number of interesting papers were read and several important items of business transacted. Some changes were proposed in the Section's constitution and bylaws, and after discussion by Dr. W. F. Faragher and the secretary, Dr. W. A. Gruse, the following resolution was adopted as a definition of the scope of the Petroleum Division: "The Division of Petroleum Chemistry shall devote its attention to the chemistry of petroleum and its products and not to the preparation of standard methods of tests and specifications; however, it shall at all times be the spirit of the Petroleum Division to co-operate if desired with other scientific societies and agencies interested in this field." In other words, a clear line of division is made between the Petroleum Division's activities and those of the A.S.T.M. committee D-2 and similar agencies interested in marketing and buyer-and-seller problems.

Physical Properties of Petroleum Oils

The first paper on the program was presented by A. P. Bjerregaard, chief chemist for the Empire Refineries, Inc., who discussed the effect of temperature changes on the volume of petroleum products, as well as the losses by evaporation and from entrapped air. His conclusions on these important questions and other useful data regarding the expansion of petroleum oils have been published in a pamphlet, which is being distributed from the company's offices at Tulsa, Okla.

An interesting discussion of viscosity measurements and the surface tension of petroleum oils followed the reading of papers by C. K. Francis and H. T. Bennett of Tulsa, of W. H. Herschel of the Bureau of Standards and W. A. Fulweiler and C. W. Jordan of the United Gas Improvement Co., of Philadelphia.

Blended Motor Fuels and Knocking

Thomas Midgley, Jr., of the General Motors Research Corporation, read a paper by T. A. Boyd and himself in which he discussed the detonation characteristics of aromatic and paraffine hydrocarbons such as met with in blended motor fuels. Knocking in internal combustion engines has been shown to be dependent on the chemical composition of the fuel and its pressure of detonation and not on pre-ignition, to which it is generally attributed. The compressions to which aromatic hydrocarbons can be subjected without detonation are very high as compared with the initial compressions that can be employed when paraffine hydrocarbons are used. But little has been known regarding the relation of the composition of blends to their detonation tendencies, one of the reasons being the lack of a suitable apparatus for conducting such tests. The laboratory of General Motors has, however, developed a special instrument consisting of a small auxiliary cylinder tapped into the cylinder head of a gas engine. The piston of this small cylinder is held firmly in place by a strong spring, but in such a way that its vibrations can be measured electrically. With the use of this instrument accurate measurements were made for a wide range of blended fuels and values were given for the limiting compression ratios at which the different blends will give combustion that is free from detonation.

Corrosion of Petroleum Refining Equipment

Ralph R. Matthews and Philip A. Crosby in two previous papers[1] had shown that in distilling mid-continent petroleum in a so-called pipe still, HCl was formed due to the hydrolysis of $MgCl_2$ in the brine associated with the crude oil. The authors used ammonia in their fractionating columns and succeeded in combating the corrosion at a comparatively small cost. This article, together with photographs of the corroded parts, will be published in an early issue of Chemical & Metallurgical Engineering.

Extraction of Gasoline From Natural Gas

F. M. Seibert, in a paper prepared by F. E. Hosmer and himself, reviewed the natural-gas gasoline industry from 1904, when two plants produced a total of 16,000 gal., to 1920, when 650 plants had an output of 483,000,000 gal. He then outlined one of the methods of gas extraction in which a great deal of progress is now being made. The author referred to the low-pressure evaporation method in which the crude product is utilized to furnish refrigeration for cooling the gas after being subjected to pressure.

After discussing briefly the use of solid absorbing materials such as activated charcoal and silica gel, attention was directed to the liquid absorbents of which either crude oil, mineral seal oil, naphtha or low-grade gasoline is used. In the crude oil process it was stated that the best results could be obtained by subjecting the gas to about 50 lb. pressure at ordinary temperatures and absorbing the gasoline at a saturation ratio up to 25 per cent.

Research Program Indorsed

The concluding feature of the Section's program was a conference on the promotion of research on petroleum. Naturally the research program outlined by Dr. Van H. Manning in his address before the general meeting of the Society formed the basis of this discussion. Willing co-operation was expressed by Dr. Bjerregaard and others. Finally by official action the Petroleum Section went on record as indorsing Dr. Manning's program and voted to appoint a committee, which should include

[1] Chem. & Met. Eng., vol. 22, No. 11, p. 491, and vol. 23, No. 23, p. 1128.

representatives of the Bureaus of Mines and Standards, and which should co-operate with Dr. Manning in promoting joint research on the chemistry and chemical technology of petroleum.

Division of Sugar Chemistry

The color of sugar and sugar products and use of various materials for decolorizing them were the subjects of discussion in one group of papers presented before this Division. There were also, of course, several important reports on analytical methods and apparatus for testing of sugar or its byproducts.

The color of the solution of a sugar is certainly not a good index of purity. This fact was well demonstrated by the data presented by F. W. Zerban, who discussed "The Color Range of Cane Sirups and Molasses." Data on about 1,000 samples were reported to show the relation between the color as tested on diluted specimens in the Hess-Ives instrument in comparison with the "purity." Only 56 per cent of the samples follow the rule of color relationship normally expected, according to Zerban's data. He presented a curve of the relation between these properties for products of Louisiana plants using the sulphitation process and developed a mathematical expression of the curve. However, this curve did not apply to Cuban molasses at all. It was shown also that where carbon had been used in connection with the processing the color was lighter than would normally correspond to the purity for similar materials not so treated. The importance of color rather than purity in fixing the commercial value of a sugar was made clear by a discussion of the results.

Decolorizing Principle of Bone Char

A preliminary report on "The Decolorizing Power of Bone Char," by P. M. Horton, was presented by C. E. Coates. Horton discussed the earlier work of Hall and of Patterson on the influence of nitrogen in bone black upon its decolorizing power. The earlier workers claim that the nitrogen-bearing bodies were the active element or at least contributed largely to the activity. Horton digested samples of the material on the water bath for 1 hour at 90 deg. C. with concentrated sulphuric acid, filtered, diluted, obtaining a gelatinous flocculent precipitate. Another sample was digested for several days with acid at room temperature and the precipitate similarly obtained. Both precipitates were dialyzed free from acid and tested for decolorizing value. It was found that when the acid was eliminated thus, the results reported by the earlier workers were not duplicated. It is therefore concluded that the activity of the char when affected by treatment is due to a change in the structure or surface of the carbon and not simply to the removal of the nitrogen-bearing material. The earlier workers probably mistook the decolorizing effect of the acid remaining in the nitrogenous material for a property of the material itself.

Bone Black vs. Activated Charcoal

C. E. Coates strongly advocated the manufacture of plantation standard granulated sugar either with or without activated char instead of shipping the plantation sugar to a refinery "owned by the trust." Emphasizing the importance of uniform size, color and purity of the finished granulated sugar for maintenance of regular trade, he insisted that small plants handling about 50 tons of sugar per day were reasonably efficient units for neighborhood operation. Even though probably not as efficient as big plants, they can be operated well enough to pay profits to plantation sugar mill owners, for the additional investment would be between $25,000 and $50,000, especially if no additional buildings were required. Any animal or vegetable chars, including bone black, require care for refinery use. Activated carbon can be used with much cheaper installation than is possible with bone black, but certain disadvantages are sometimes met, for chars are sold on a royalty basis, often with exaggerated claims as to their possibilities, and no standard procedure for use has been generally established. Difficulty in filtration of material decolorized by activated char is met if great care is not used; but with proper chemical research and development, Prof. Coates believes there is some net advantage for the activated char in comparison with bone black. He states the loss in reactivation is 1 to 2 per cent, but care and proper treatment is essential or the value after processing is seriously decreased. Reactivated char costs $15 per ton for recovery, in contrast from six to ten times this price for new material. It can be used thirty to fifty times before discarding and the total cost of the char should be about 2c. per 100 lb. of sugar refined. This is a trifle higher than bone black cost, but the investment is sufficiently less to offset the difference.

Color and ash absorption by bone black and by decolorizing carbons was discussed by W. B. Horne, who claimed that the carbons, though superior in color absorption, removed no ash. Tests of carbon fixed on a porous earthy base gave encouraging results for ash as well as for color removal. Dr. Horne assumes in his comparison that removal of 0.2 per cent of ash from the raw sugar by bone black gives a 1 per cent increase in sugar recovery; however, he does not reconcile this with the ratio of 2 to 1 commonly reported by refiners. His cost comparisons are all on the 5 to 1 assumption.

C. E. G. Porst, director of research of the Corn Products Refining Co., with M. Moskowitz, discussed plastometer tests on alkaline thin boiling cornstarches, giving a mathematical and experimental report of results. Alkali addition produces a firmer paste almost up to the neutral point, but further addition weakens the paste, though it makes it smoother, translucent and of better spreading power.

M. Louis Baissac of the Island of Mauritius informally discussed some of the conditions and problems of sugar production in the tropical islands of Australasia. Much plantation white sugar is made in that territory, but no decolorizing carbons are used there as yet. The luxuriant growth of vegetation in some of this country is well shown by the yield on certain special plots of cane where 15 to 17 tons of finished sugar per acre have been manufactured in certain seasons.

Division of Physical and Inorganic Chemistry

The growing interest in colloids was reflected in the fact that one-third of the papers of this Section were devoted to colloidal or closely related subjects. The start is being made to place the study of the physical properties of colloids on a quantitative basis. Important additions to colloidal science, followed shortly by industrial applications, are bound to result from this method of treatment.

Whenever a capillary tube method is used to measure the viscosity of a viscous liquid there is an error due to incomplete drainage which is larger the greater the

viscosity and the shorter the time of drainage. This error may be as great as 1.5 per cent. A table should be worked out for the corrections required for oils of different viscosity and for varying drainage periods, according to Bingham and Young of Lafayette College. The present unsatisfactory means for comparing the yield value and mobility of a paint with its so-called painting consistency was pointed out by Bingham and Bruce. A committee recently appointed to report on standard samples of paint had been able to make only rather rough estimates. By plotting the volume flow against shear the results lie on a straight line within the error of the stop watch used. This line when extrapolated to zero volume flow should give a value accurate to a very few per cent of the minimum yield value of any given plastic material. In the discussion it was brought out that starch pastes follow a slightly curved line and gelatine a straight line.

Crystalline Structure

Two papers were presented on the lattice structure of crystals. Dr. Sosman showed a model to help explain the idiosyncrasies of silicon dioxide in its various minerals, while Dr. Wherry is of the opinion that the electrons are held rather rigidly in the crystalline lattice and that frequently an electron is shared by more than two atoms. The conception of the "domain" of the atom was defined as the space reserved for each atom as bounded by planes which bisect the lines joining atomic centers. The fact was pointed out that very few of the atomic domains were in the simplest geometric forms but occurred usually in truncated modifications thereof.

Papers by Edward C. Franklin and by Cady and Elsey described some interesting reactions taking place in anhydrous ammonia and pointed out the similarity of nitrogen and oxygen compounds—e.g., nitric acid and its counterpart, ammono-nitric acid or hydrazoic acid.

Glue and Gelatine

Dr. R. H. Bogue of the Mellon Institute read an interesting paper on the connection between the hydrogen-ion concentration and the properties of emulsoid colloids. In the determination of the content of jelly a concentrated solution of magnesium sulphate is used to precipitate out the jelly which is least soluble at its isoelectric point. In studying the joining strength, so important for glues, the optimum acidity produced a change in the viscosity of a 1 per cent solution by only 7 centapoises from the least favorable concentration. The determination of viscosity with an ordinary pipette involves a change of about 10 centapoises for every second read on the stopwatch—far too crude a measure. At the isoelectric point the ions of electrolytes are most easily washed out. There are a very great number of plant operations where the concentration of the hydrogen ion should be known and controlled.

Ash-free gelatine was prepared by Sheppard and Sweet of the Eastman Research Laboratories by passing a 220-v. direct current through a 5 per cent gelatine near its isoelectric point. Then on precipitating with redistilled acetone but 0.01 per cent ash was left. The elasticity as shown by twisting various cylinders of different concentrations of gelatine did not have any special properties at the isoelectric point. The interfacial tension against toluene, on the other hand, was found, by the drop number method, to exhibit maxima at the isoelectric point for most concentrations and at a variety of temperatures. The addition of aluminum salts caused a shift of the maximum to the alkaline side. Inorganic gels are formed either by an interlacing of threads or by films surrounding the disperse medium, according to Dr. Harry B. Weiser of the Rice Institute. A study of the behavior of dibasic organic acids and ethereal salts on water surfaces was described by King and Wampler in light of recent work by Langmuir and Harkins. In general, the adsorption of the dibasic acid is less than that of monobasic acids, although the results among different acids are somewhat irregular. Prof. Jack P. Montgomery of the University of Alabama described the adsorption of alkali halides by barium sulphate as being almost in the order of molecular weights. Lithium chloride was scarcely adsorbed at a concentration up to a millimol in 50 c.c.

New Apparatus

An interesting thermoregulator has been developed by E. B. Starkey and Prof. Gordon, as shown in Fig. 1. The tarnishing of the surface of mercury where the make and break occurs is done away with. The capillary tube contains air, but the oxygen is eliminated with the first spark or two. Toluene is placed in the bulb and the amount can be regulated through the stopcock *S* when working at different temperatures.

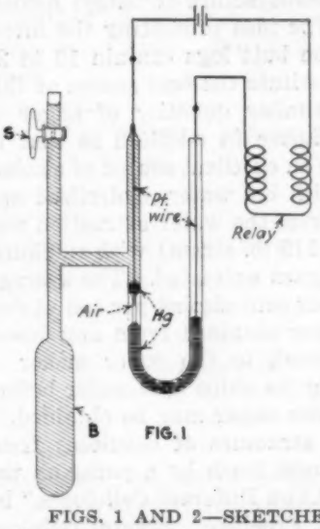


FIG. 1

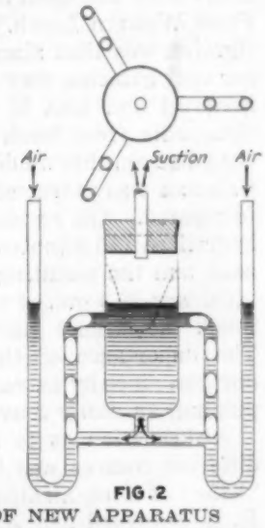


FIG. 2

FIGS. 1 AND 2—SKETCHES OF NEW APPARATUS
1—A thermoregulator with a clean mercury contact surface.
2—A simple cell for rapid electroanalysis.

A simple and easily constructed cell for rapid stirring of the electrolyte was described by Prof. Edgar of the University of Virginia. By applying water-pump suction to the top of cell, as shown in Fig. 2, air is drawn up through the three side arms so rapidly that a marked vortex is produced. This eliminates any tendency to entrain spray and permits very rapid analytical depositions.

Section of Cellulose Chemistry

The work of the Forest Products Laboratory stood out prominently in the meetings of the Cellulose Section, at which thirteen papers were presented and discussed. The report of the committee on the preparation of standard cellulose was accepted with certain modifications. In this connection W. O. Mitschlering, Atlas Powder Co., read a paper on the "Use of Standard Cellulose." The object of the investigations reported was to introduce a normal cellulose into experimental laboratories. It was found that when normal cellulose was used for nitrating purposes, the spent acid obtained was purer than that from the nitration of ordinary

plant cellulose, the product was more uniform and the loss of cellulose during nitration was lower. A revised method for testing the viscosity of cellulose solutions was devised by which the cellulose passes into solution immediately and is tested in a neat falling sphere viscosimeter designed by the author.

Harold Hibbert presented a résumé of work done by himself and co-workers on the synthesis of various cyclical acetal derivatives. The value of the work as stated by Dr. Hibbert lies in the fact that such derivatives are very closely related structurally to the pentosanes, hexasanes, starch and cellulose. It is hoped that from a knowledge of the behavior of these synthetic products toward acids, alkalis, bisulphites, etc., valuable information will be obtained relative to the action of sulphites, for instance, on related derivatives present in wood. Knowing the limits within which the stability of such materials lie may result in information which will make possible increased yield of paper pulp by the bisulphite process.

Work of Forest Products Laboratory on Hydrolysis and Fermentation

Five of the papers from the Forest Products Laboratory were read by E. C. Sherrard. One of the most interesting discussed the manufacture of "Ethyl Alcohol From Western Larch." The idea prompting the investigation was that since the butt logs contain 10 to 25 per cent galactan they constitute the best source of this material and that if a similar quantity of sugar is obtainable from larch cellulose in addition to that in the galactan, this would be an excellent source of alcohol. Galactan was extracted with hot water, hydrolized and fermented. The residue from the water extraction was hydrolized (15 minutes at 115 lb. steam) with sulphuric acid, and the resulting sugars extracted. The average yield was 39.9 gal. of 95 per cent alcohol per ton of dry wood, the largest yield ever obtained from any wood. The importance of this work to the paper maker is obvious, since by extracting the chips with water before pulping, an easily convertible sugar may be obtained.

A discussion as to the structure of celluloses from different sources was brought forth by a paper on the "Effect of Concentrated HCl on Different Celluloses," by E. C. Sherrard and A. W. Froehlke. Several cellulose samples from woods and cotton were treated with HCl and the change of angular rotation observed. Curves in which specific rotation was plotted against time show marked differences, indicating differences in the structure of the celluloses.

Additional evidence of differences in the chemical structure of wood cellulose from that of cotton cellulose was offered as a result of investigations by E. C. Sherrard and G. W. Blanco into "Some of the Products Obtained in the Hydrolysis of White Spruce." In this work, the volatile products, the soluble materials and the fibrous residue have all been studied. The best cooking conditions were determined. The yield of volatile acids was found to be 1.9 per cent of the dry wood used, the yield containing four times as much acetic as formic acid. Methods for the identification and determination of various sugars were developed. A yield of furfural was obtained equal to twice the yield of volatile acids.

"Sugar Formation in a Sulphite Digestor," by E. C. Sherrard and C. F. Suhm, discussed the rate of sugar formation during the pulping process and the effect of the formation on the quality of pulp. It was found that the rate of sugar formation is influenced mostly by the temperature and the concentration of free SO_2. Time is also a factor, since prolonged cooking increases sugar production, but at the expense of cellulose.

"The Results of Analyses of Some American Woods," read by L. F. Hawley, presented the work of the Forest Products Laboratory on Western woods as possible substitutes for those species which are becoming scarce. The acetic acid content, pentosane, methoxy and furfural content of eight species was determined. Dr. Hawley also presented some recent results on the distribution of methoxy groups in the products of wood distillation, by L. F. Hawley and S. S. Aiyar.

"The Analysis of Western White Pine and Eucalyptus," by S. A. Mahood and D. E. Cable, gave interesting figures on the yield of acetic acid from the two woods and a comparison of their lignin and alpha cellulose content.

Symposium on Production of Cattle Feeds From Waste Cellulose

A symposium on the production of cheap cattle feed from wood waste brought out some interesting discussion. E. C. Sherrard described the acid hydrolysis of sawdust for production of feed and the experiments of Prof. Morrison of Wisconsin University in substituting this product for barley in the standard cattle ration. Harold Hibbert described the Oexmann process of treating straw with alkali under pressure for the production of a feed which is 75 per cent edible. An improvement over this process is the Beckmann method, by which 100,000 tons of feed was made in Germany in 1918. Chopped straw is treated for 3 hours at 100 deg. C. with a 1 per cent Na_2CO_3 solution. Since no pressure is required, this can be carried out by any farmer and yields a feed which is 75 per cent edible, whereas the original chopped straw was less than 20 per cent edible.

Division of Dye Chemistry

Of the twelve papers scheduled for the Dye Division, only six were read, as several of the authors were not present. R. N. Shreve, secretary of the Division, presided.

Herbert L. Haller's paper on the preparation of phenylglycine ortho carboxylic acid from anthranilic acid and monochloracetic acid was read by Max Phillips of the Color Laboratory, Bureau of Chemistry. The paper discussed the optimum conditions of concentration, time, temperature, ratio of reacting materials and condensing agent as determined by experiment. This process was said to be used commercially in France.

"The Preparation of 7-7′ Di (alpha-hydroxyisopropyl) Indigo" was the subject of a paper by Max Phillips. It described the preparation of a new indigo dye from paracymene obtained from sulphite turpentine. The new dye has a similar absorption spectrum to that of indigo and compares favorably in dyeing properties. It is soluble in most organic solvents. Thus far the yield obtained is only about 15 per cent theoretical.

"The Influence of Sulphur on Colors of Azo Dyes" was the subject of a paper by W. R. Waldron and E. Emmet Reid, read by the latter. Dr. Reid exhibited several series of wool samples in connection with his talk, showing the effect of sulphur in the sulphide and sulphone condition in comparison with the sulphur-free base. Thirty different bases containing sulphur in various positions and associated with various alkyl and aryl radicals were prepared, diazotized and coupled with dye intermediates. It was found that sulphide sulphur

deepens the color, but the sulphone group gives a color even lighter than that of the base.

"Uses of Paratoluenesulphonyl Chloride in the Manufacture of Dyes and Intermediates" was the title of a paper by Jules Bebie, Monsanto Chemical Co. This substance is a byproduct in the manufacture of saccharin. One of its derivatives, chloramine-T, is an excellent germicide. It can be used as a component or part of a component for the production of various classes of azo dyes and in combination with azo dyes containing hydroxyl groups to make the resulting dyes fast to alkali and soap.

"The Application of the Direct Dyes in Coloring Paper," by Walter C. Holmes, E. I. du Pont de Nemours & Co., was read by title by A. E. Houlehan. The paper discusses the ineffectiveness of customary trade practice for sized papers due to the formation of considerable proportions of aluminum lakes of undesirable characteristics. A large range of attractive shades of superior fastness are said to be possible by judicious employment of copper lakes of various individual dyes and combinations.

"The Analysis of Beta Naphthylamine," by Henry R. Lee and D. O. Jones, was read by the former. Four methods for this determination were discussed, with advantages and comparative results. Melting point curves for beta naphthylamine with each of its usual impurities were given.

Division of Organic Chemistry

A most ambitious program of thirty-odd papers was scheduled for the Division of Organic Chemistry and long sessions were held on both Wednesday and Thursday. The chairman, Dr. Hans T. Clarke, had not recovered sufficiently from his recent illness to attempt the long trip to Birmingham, and in his absence the meetings were conducted by Prof. Frank C. Whitmore, secretary of the Division. Unfortunately lack of space in this issue precludes the detailed mention of the many interesting and valuable papers which were presented before the organic chemists, but it is at least worth while to comment on an important innovation introduced by this Division. On March 25, well in advance of the Birmingham meeting, Dr. Whitmore sent a complete set of abstracts of all papers to each member enrolled in the Division. This action not only stimulated the interest of organic chemists in the work of the Division but afforded an opportunity for those unable to attend the meeting to follow its progress. It is the belief of the Division's officers that only a small proportion of the organic chemists of the country are now enrolled in the Division of Organic Chemistry, and it is suggested that those interested in receiving copies of abstracts communicate with Dr. Whitmore, of Northwestern University, at Evanston, Ill.

Division of Rubber Chemistry

It will be recalled that at the New York meeting the Division of Rubber Chemistry went on record as favoring the formation of a central research laboratory under the direction of the Rubber Association of America. After due deliberation the Rubber Association has decided that the time is inopportune for such an undertaking and is, therefore, taking no action at present.

The Geer age test was formally adopted as the standard age test of the Division. The feeling was expressed by Mr. Boggs and others that the present specifications containing limits on extracts, total and free sulphur, etc., are restricting development. Physical and life tests were considered much more reasonable. The Rubber Division methods of chemical analysis are now ready for publication and will be taken up for approval at the September meeting. The physical testing committee has prepared agenda and will report at the September meeting.

Internal Mixers

R. P. Dinsmore reported on an elaborate series of experiments on internal mixers performed at the Goodyear Tire & Rubber Co. One gathered from his paper that the results have not been entirely satisfactory. He met with least difficulty in low-grade compounds. He mentioned the interesting observation that rubber which is plasticized by heat at high temperature, such as is obtained in the internal mixers, has a greater recovery—that is, is stiffer—when cooled than stock broken down to the same apparent plasticity on the mill.

Thermal Properties of Rubber and Rubber Pigments

Extensive experiments to determine the specific heat and conductivity of rubber fabric and were summarized by Ira Williams in a paper on "Thermal Properties of Rubber and Rubber Pigments." This matter is of great importance. Mr. Williams' tables will be found below.

THERMAL CONSTANTS OF PIGMENTS

Pigment	Sp.Gr.	Sp.Ht.	Conductivity (C.G.S. Units)
ZnO	5.5	0.125	0.00166
Red oxide	4.7	0.160	0.00132
$MgCO_3$	3.0	0.303	0.00103
Lithopone	3.95	0.115	0.00094
Whiting	2.68	0.201	0.00084
Cord fabric*	1.5	0.324	0.00082
Blanc fixe	4.35	0.114	0.00078
Gas black	2.0	0.204	0.00067
Dixie clay	2.6	0.200	0.00058
Talc	2.70	0.209	0.00058
Litharge	9.25	0.052	0.00051
Rubber, smoked sheet crepe, etc., including cured	0.92	0.502	0.00032
Golden antimony	3.20	0.025	0.00021
Sulphur	2.00	0.175	0.00012

*Approximate

Physical Properties of Rubber Compounded With Light Magnesium Carbonate

H. W. Greider made a study of the physical properties of rubber compounded with light magnesium carbonate. The dolomite deposits of Pennsylvania furnish an adequate supply of raw materials. Best grades of precipitated carbonate approximate $11MgCO_3 . 3Mg(OH)_2 . 11H_2O$. The water is probably chemically combined. No decomposition below 265 deg. C. The light magnesium carbonate has a specific gravity of 2.18. Extensive compounding data show 9 volumes magnesium carbonate to 100 volumes rubber to be the optimum ratio. This corresponds to 21 parts by weight on rubber. Magnesium carbonate ranks as a filler between zinc oxide and carbon black. The high set imparted will restrict its use. Surface aging of stocks high in carbonate is bad, due probably to crystals of carbonate. Mixtures of carbon black and magnesium carbonate, 6 volumes and 3 volumes, respectively, to 100 of rubber, show greatest stiffening action. The combination of zinc oxide and magnesium carbonate is the best aging. Work is going forward on producing an amorphous magnesium carbonate which the author hopes will overcome the high set.

Stress-Strain Curves

W. B. Wiegand presented some excellent ideas on a standardized graph for stress-strain curves, etc., for the purpose of making the work of the various investigators more comparable. This matter was referred to the physical testing committee.

Relation Between Chemical and Physical State of Cure

The relation between chemical and physical state of cure of rubber vulcanized in the presence of certain organic accelerators was discussed by Norman A. Shepard and Stanley Krall. Their paper dealt with the old question of the relation between physical properties and coefficients of vulcanization. Experiments were performed with several common accelerators. The accelerator ratios were varied until the stress-strain curves at a definite cure—namely, 60 minutes at 141.7 deg. C.—passed through a definite point. In this manner they secured the same depolymerization from heat in all cases. It was found that equivalent stress-strain curves under these conditions were given with the following compound:

Base Stock:	
Rubber	48
Zinc oxide	48
Sulphur	3
Equivalent accelerator ratios:*	
Hexamethylenetetramine	0.5
Paranitrosodimethylaniline	0.25
Aldehyde ammonia	0.75
Thiocarbanilide	1.5

*The amounts of accelerator shown were added to four different mixes of the base stock.

The coefficient of vulcanization was obtained as follows:

Extraction 16 hours in an Underwriter's flask with acetone; 5 hours' extraction with alcoholic potash; 16 hours' extraction with alcohol followed by treatment with an ether hydrochloric mixture, as according to Stephens, followed by long extraction with water to remove all soluble sulphates. Sulphur was then determined by the Watters and Tuttle method. Coefficients of vulcanization were as follows: 0.87 with hexa-, 1.03 with paranitroso, 0.98 with aldehyde ammonia, and 1.38 with thiocarbanilide. The authors therefore conclude that vulcanization coefficient has no relation to physical properties and that the various accelerators have a specific action other than sulphur addition.

Recent Developments of the Chemistry of Rubber

Dr. Geer repeated his very interesting talk before the Rubber Division.

Approximately thirty-five members attended the meeting of the Division.

Division of Water, Sewage and Sanitation

Prof. Edward Bartow, of the State University of Iowa, read a paper prepared by himself and two of his associates, M. E. Flentje and W. U. Gallaher, discussing the effect of temperature on the rate of reaction in water softening by the lime-soda ash method. Although the reactions in this process are well known, the effect of heat has not been definitely established in the literature. Furthermore, the manufacturers of hot lime-soda water softeners have made public but little of their own data on this subject.

The experimental work described in this paper was conducted on the deep-well water of Iowa City, which has a mineral acid hardness around 95 p.p.m. A special apparatus was developed which could be heated electrically to a constancy of 0.5 deg. In addition to temperature variations, the amount of lime was varied to ascertain the effect of mass action on the process. It was used both in excess and in lesser quantity than that theoretically required for complete softening.

The principal conclusions of the authors were as follows:

1. The rate of reaction increases with lime provided sufficient sodium carbonate is added to neutralize the non-carbonate hardness.

2. The rate increases greatly with the rise in temperature; the greatest relative increase in rapidity probably occurs in the 18-20 deg. C. rise above normal.

3. Completeness of reaction also increases with temperature and the first 18-20 deg. is likewise most effective. The time of reaction is cut from 4 hours to 30 minutes. At a rise of 40 deg. the reaction is almost instantaneous—in fact there would appear to be no justification for heating above 65 deg. C.

4. With increasing temperature a small decrease was noted in the amount of lime required for softening.

Mechanism of Iron Removal

Prof. A. M. Buswell, chairman of the Division, gave an interesting discussion of the mechanism of iron removal. Our prior knowledge of iron in water has been very ably summarized in a long paper presented by Robert Spurr Weston[1] in 1909 and Dr. Buswell limited his comments to more recent developments. In connection with the two usual methods of removal—viz., filtration and aëration followed by filtration—it was pointed out that detention after aëration is not particularly effective, since even 6 hours fails to remove more than 25 per cent of the Fe. The probable explanation is that the iron is still in colloidal form. Gravel filters, probably by adsorption, will remove 25 per cent and thus lessen the load on slow sand filters.

The fact that lime will remove iron, while alum is not so effective, can be explained on the basis that the $CaCO_3$ resulting from the lime forms negatively charged particles which attach themselves to the colloidal suspension. Alum, on the other hand, forms positive colloids which do not exhibit the "attaching" power of the $CaCO_3$. This theory is confirmed by the fact that other negatively charged particles such as clay and diatomaceous earth act in a manner similar to lime.

Dr. W. W. Skinner, secretary of the Division, summarized two papers from his laboratory at the Bureau of Chemistry. The first, by J. W. Sale, discussed the determination of specific gravity of mineral waters by calculation. The second, by Dr. Skinner and Messrs. Badger and Sale, outlined a number of interesting reminiscences regarding the unusual compositions noted in certain bottled mineral waters.

The Value of the p_H Determination in Water Treatment

Chairman Buswell also summarized a paper by Dr. W. D. Hatfield on the application of p_H value to the operation of a filter plant. After reviewing the various methods for determining the hydrogen-ion concentration, the author concludes that the colorimetric methods

[1] "Purification of Ground Waters Containing Fe and Mn," *Trans.*, Am. Soc. C. E., vol. 64, pp. 112-207 (1909).

are more satisfactory than the electrometric. He has found the buffer solutions of Clark and Lubs to be the most useful. Among his principal conclusions are that the amount of alum used is dependent upon the buffer value of the water, which in turn is roughly dependent upon the methyl orange alkalinity. Coagulation begins at a p_H value of 7.8 and in the summer months is satisfactory at around 7.6. The most efficient results at the Highland Park (Detroit, Mich.) filter plant over several months demonstrated an optimum value of 7.3. In the discussion of this paper it was pointed out that these conclusions are of course applicable only to the single plant studied.

Dr. Buswell, in a lucid discussion of the chemical equilibria in the coagulating basin, drew a chart which showed the striking importance of the hydrogen-ion concentration. It was made very evident that all of the basic reactions in water treatment are more or less dependent upon this factor. Much of the work which has been done recently, especially by the engineers, to simplify water chemistry has been at the expense of neglecting many of the underlying fundamentals such as are considered in Dr. Buswell's paper.

The Smoker

On Tuesday evening the members of the Society were the guests of the Alabama Technical Association at a smoker given at the Southern Club of Birmingham. The hosts, who are the Alabama members of the leading national engineering societies, provided an interesting program of music, vaudeville and good fellowship. Perhaps the most popular as well as unusual feature of the program was the characteristic negro melodies sung by a chorus from the Colored People's Sixteenth Street Baptist Church.

Excursions to Plants

The Tennessee Coal & Iron Co.'s Special

Through the energetic efforts of the Alabama Section's committee on excursions, of which J. R. Harris was chairman, and through the courtesy of the Tennessee Coal, Iron & Railroad Co., about two hundred members were enabled to visit the numerous industrial plants clustered in the Birmingham Valley. A special train was furnished which left Birmingham at 9 a.m. on April 7 and carried the members to the iron, coke, steel and wire works and to the iron and coal mines, stopping at each point of interest long enough for a brief inspection trip through each plant.

Although any of the plants visited would have offered enough of interest to consume several days of inspection, the well-planned excursion served admirably to give the members a birdseye view of this industrial center of the South. In this richly endowed valley were seen iron and coal mines, limestone quarries, gravel beds and byproduct coke plants within a radius of a few miles. the longest rail haul required for any of the raw materials of the steel works being 14 miles. The morning of the trip included stops at the Ensley plant of the Tennessee Coal & Iron Co., where the blast furnaces and open hearths were seen in operation, a visit to the Bessemer rolling mills, which were rolling out steel rails, and stops at Ishkooda iron mine and the coal mine at Edgewater. Arrived at Bayview, the members were greeted by the strains of "Dixie," while on the slope above a beautiful lake were found tables loaded down with barbecued meat and Southern delicacies and even a mysterious tent which was rumored to contain a high explosive, manufactured from corn in the nearby hills of Shelby county.

After a hearty luncheon, the special train proceeded to the T.C.I. byproduct plant, which was thrown open for inspection; thence to the Fairfield blooming mill, where the plate and structural mills, tie plate department and car plant were seen. The final stop was made at the American Steel & Wire Co. and opportunity was afforded for seeing the drawing of wire, the weaving of wire fences and the manufacture of wire nails. Not one of the tired chemists that tumbled from the train at 6 o'clock in Birmingham but had conceived an admiring appreciation of the industrial activity of this section.

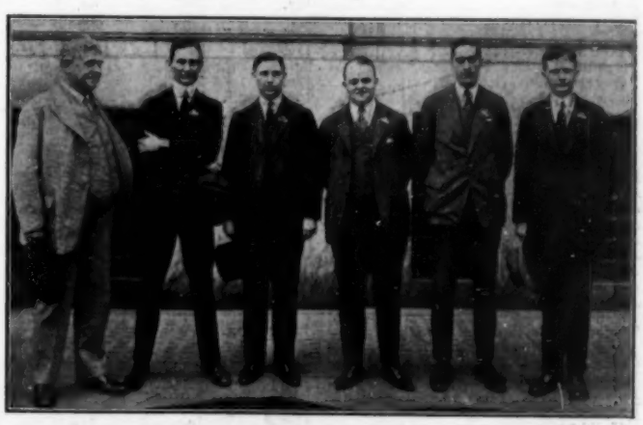
Additional opportunity was afforded on Saturday, April 8, for visits to the American Cast Iron Pipe Co. and the fertilizer and cement plants in the vicinity of Birmingham. Great credit is due to the local committees, not only for the well-planned trips but for the excellent arrangements for meeting places, entertainment and transportation. The executive committee was composed of J. F. Carle, chairman; Theodore Swann, C. N. Wiley, M. Kuniansky, J. T. MacKenzie, J. R. Harris, H. S. Geismer and A. K. Boor.

Visit to Muscle Shoals

A desire on the part of many to visit the Muscle Shoals nitrate plants and power site resulted in arrangements being made for special sleepers leaving Birmingham Friday night and arriving at Sheffield Saturday morning. About fifty made the trip, the delegation being divided at Sheffield into two parties, those who intended to spend the entire day there and those who wished to leave early in the afternoon. Members of the Sheffield Chamber of Commerce very kindly furnished automobiles and conducted the parties through plants 1 and 2, and the steam power plant on the Tennessee River, which were thrown open for the occasion. In the afternoon the visitors were afforded the privilege of a detailed and extremely interesting inspection of Wilson dam under the expert guidance of Colonel Weeks, officer in charge of construction.

The two crowded days of excursions and sightseeing brought a successful meeting to a fitting close. Each homeward-bound member carried away a jumble of pleasant impressions — the beauty and hospitality of Birmingham, her remarkable industrial activity, the magnitude of the Muscle Shoals project, the solid support which Henry Ford has in the South, the hospitality which was manifested everywhere and recollections of friendship renewed and made.

Au revoir, Dixie, and thank you!



E. H. H. C. P. Wik Kirk Buck Mack
"CHEM. & MET.'S" DELEGATION AT BIRMINGHAM

Chemical Schedule of the Senate Tariff Bill

A Study of the Changes Proposed in the Fordney Measure Which Will Most Affect the Chemical Industries—Provisions for Flexible Tariff and Temporary Extension of Dye Embargo—Tabular Comparison of Rates With House Bill and Existing Law

AFTER nearly 9 months of study and preparation the majority members of the Senate Finance Committee have reported their long-expected revision of the permanent tariff bill. Although many important changes have been made in the draft approved by the House, a long and bitter fight is in prospect before the bill is finally written on the statute books. A number of the crudities and rough spots in the Fordney measure have been smoothed over and notable improvement made in the elimination of certain provisions of questionable merit.

As in past tariff laws, ad valorem rates in the Senate bill are based on the foreign value of imported merchandise. The American valuation plan as embodied in the bill passed last July by the House was abandoned because of the limited number of exactly comparable domestic and foreign products and the difficulty and probable litigation involved in defining comparability to the satisfaction of importers, domestic manufacturers and customs officials.

As a substitute measure the committee has incorporated provisions for a flexible tariff and proclaimed American valuation such as had been recommended by President Harding. The elasticity in the tariff has been provided by giving the President authority to increase or decrease the rates not exceeding 50 per cent, if after investigation he finds such action is necessary. The President is also empowered to change the basis of valuation on certain items from the foreign value to the value of the domestic article; to impose penalty duties and prohibit the importation of particular goods; and to impose additional retaliatory duties against any country which discriminates against us.

Embargo on Dyes and Synthetic Organic Chemicals

So far as the chemical industries are concerned the outstanding feature of the tariff bill is the extension for 1 year of the dye and chemical control provisions of the emergency tariff act. A last-minute change before the bill was reported provided that the President could extend the embargo for an additional year if it should be found necessary. Chairman McCumber, in the report which accompanied the bill, gives the following explanation of the committee's attitude toward the domestic dye and synthetic organic chemical industries:

> It was found that the rates provided for dyes and coal-tar chemicals, after the limited embargo provisions covering these products had been eliminated on the floor of the House of Representatives, were wholly inadequate to protect the domestic industry.
>
> It is common knowledge that Germany had a monopoly of the world's trade in dyes prior to the war. Although our domestic industry has made great strides during and since the war, when these products have been admitted to the United States only under license, as provided by the emergency tariff act of May 27, 1921, and although our industry is capable of supplying between 85 and 90 per cent of the quantity required by domestic consumers, it has not attained a point of efficiency of manufacture where it can hope to compete with the well-organized industry which exists in Ger-

RATES OF DUTY ON IMPORTANT CHEMICALS IN SENATE BILL COMPARED WITH THOSE IN HOUSE BILL AND UNDERWOOD-SIMMONS ACT

Specific duties on per pound basis unless otherwise noted

Commodity	Underwood-Simmons Act of 1913	Fordney Bill of 1921	Fordney Bill of 1922
Acetic acid, 65% and less	Free	¼c.	¼c.
Acetic acid, over 65%	Free	2c.	2c.
Acetic anhydride	2½c.	8c.	5c.
Boric acid	½c.	2c.	1½c.
Chloroacetic acid	15% n.s.p.f.	5c.	5c.
Citric acid	5c.	12c.	18c.
Lactic acid	1½c.	1½c.–3c.†	2c.–4c.†
Tannic acid and tannin	5c.	4c.–20c†	4c.–20c.†
Tartaric acid	3½c.	6c.	6c.
Arsenic and arsenious acids	Free	25%	3c. and 2c.
Formic acid	1½c.	25%	4c.
Gallic acid	6c.	25%	8c.
Oleic acid	15% n.s.p.f.	25%	1½c.
Oxalic acid	1½c.	25%	4c.
Phosphoric acid	Free	25%	2c.
Pyrogallic acid	12c.	25%	12c.
Stearic acid	15% n.s.p.f.	25%	1½c.
Acetaldehyde, etc	15% n.s.p.f.	6c.+30%	6c.+30%
Acetone	½c. per lb.	25%	25%
Alcohol, amyl	½c.	6c.	3c.
Alcohol, butyl and propyl	½c.	6c.	3c.
Fusel oil	½c.	6c.	2c.
Alcohol, methyl	Free	15c. per gal.	10c. per gal.
Alcohol, ethyl	$2.60 gal.	15c. per gal.	10c. per gal.
Aluminum hydroxide	15%	½c.	½c.
Alum	15%	½–¾c.†	½–¾c.†
Ammonium carbonate	½c.	1½c.	1½c.
Ammonium chloride	½c.	1½c.	1½c.
Ammonium sulphate	Free	½c.	½c.
Anhydrous ammonia	2½c.	2½c.	2½c.
Antimony oxide	25%	2c.	1½c.+25%
Tartar emetic	15% n.s.p.f.	5c.	6c.
Argols and wine lees	5%	5%	5%
Cream of tartar	2½c.	5c.	5c.
Rochelle salts	2½c.	5c.	5c.
Balsams, crude	10%	10%	10%
Balsams, refined	15%		
Barium carbonate	½c.	1½c.	1½c.
Barium chloride	½c.	1½c.	1½c.

Commodity	Underwood-Simmons Act of 1913	Fordney Bill of 1921	Senate Bill of 1922
Barium dioxide	1½c.	4c.	4c.
Barium hydroxide	15% n.s.p.f.	25% n.s.p.f.	1½c.
Barium nitrate	15% n.s.p.f.	2c.	2½c.
Bleaching powder	½c.	½c.	½c.
Caffeine	$1	$1.50	$1.50
Tea waste	1c.	1c.	1c.
Calcium carbide	Free	1c.	1c.
Calomel	15%	30%	45%
Carbon tetrachloride	1c.	2½c.	2½c.
Chloroform	2c.	8c.	6c.
Chalk, precipitated	25%	15%	35%
Chicle, crude	15c.	15c.	15c.
Chicle, refined	20c.	20c.	20c.
Chloral hydrate	25%	25%	35%
Terpin hydrate	25%	25%	35%
Thymol	25%	25%	35%
Urea	25%	25%	35%
Glycerophosphoric acid	25%	25%	35%
Coal-tar intermediates	10%	7c.+30%	7c.+50%
Coal-tar dyes medicinals, etc	30%	7c.+35%	7c.+60%
Cobalt oxide	10c.	20c.	20c.
Collodion	15%	35c.	35c.
Pyroxylin, unfinished	25%	40c.	40c.
Pyroxylin, finished	40%	65c.+25%	60%
Drugs, crude	Free	Free	Free
Drugs, advanced	10%	10%	10c.
Buchu leaves	10c.	10c.	10c.
Coca leaves	10c.	10c.	10c.
Gentian	½c.	½c.	½c.
Licorice root	½c.	½c.	½c.
Sarsaparilla root	1c.	1c.	1c.
Belladonna	10%	25%	3c.
Digitalis	10%	25%	3c.
Henbane	10%	25%	3c.
Stramonium	10%	25%	3c.
Cyanide: potassium cyanide, sodium cyanide, compound and mixtures	Free	Free	10%
Ergot	10c.	10c.	10c.
Diethyl sulphate	15% n.s.p.f.	25%	15c.

Commodity	Underwood-Simmons Act of 1913	Fordney Bill of 1921	Senate Bill of 1922
Dimethyl sulphate	15% n.s.p.f.	25%	15c.
Ethyl acetate	5c.	4c.	3c.
Ethyl chloride	20%	15c.	15c.
Ethyl ether	4c.	6c.	4c.
Extracts for dyeing and tanning	½c.	11%	25%
Flavoring extracts, non-alcoholic	20%	25%	25%
Formaldehyde	1c.	2½c.	2c.
Hexamethylenetetramine	15% n.s.p.f.	25%	10c.
Glycerine, crude	1c.	1c.	1c.
Glycerine, refined	2c.	3c.	2c.
Ink and ink powders	15%	20%	30%
Iodine, resublimed	Free	20c.	20c.
Bromine	Free	10c.	5c.
Bromine compounds	n.s.p.f. 15%	10c.	8c.
Lead acetate, white	1½c.	3½c.	2½c.
Lead acetate, brown	1c.	2½c.	2c.
Lead nitrate	1½c.	2½c.	3c.
Lime, citrate of	1c.	7c.	6c.
Magnesium carbonate	1½c.	2½c.	2½c.
Magnesium chloride	15% n.s.p.f.	½c.	½c.
Magnesium sulphate	1/10c.	½c.	½c.
Magnesium oxide	3½c.	7c.	7c.
Magnesia, calcined	Free	½c.	½c.
Manganese: borate, resinate, sulphate and all other manganese compounds and salts, n.s.p.f.	15% n.s.p.f.	25% n.s.p.f.	25%
Menthol	50c.	25%	50c.
Camphor, crude	1c.	1c.	1c.
Camphor, refined	5c.	6c.	6c.
Oils, animal, n.s.p.f.	15%	20%	20%
Oils, fish, n.s.p.f.	3c. per gal.	20%	5c. per gal.
Oils, expressed, n.s.p.f.	15%	20%	20%
Castor oil	12c. per gal.	4½c.	3c.
Cottonseed oil	Free	2c.	3c.
Coconut oil, crude	Free	2c.	4c.
Soya-bean oil	Free	2c.	3c.
Hempseed oil	3c. per gal.	1½c.	1½c.
Linseed oil	10c. per gal.	2½c.	3½c.
Olive oil, less than 5 gal.	30c. per gal.	7½c.	50c. per gal.
Olive oil, more than 5 gal.	20c. per gal.	6½c.	40c. per gal.
Peanut oil	6c. per gal.	2½c.	4c.
Poppyseed oil	6c. per gal.	2c.	2c.
Rapeseed oil	6c. per gal.	1½c.	6c. per gal.
Turkey-red oils	25%	25%	35%
Oils, essential, n.s.p.f.	20%	25%	25%
Orange and lemon oils	10%	20%	30%
Peppermint oil	25c.	25%	25%
Opium, crude	$3	$3	$3
Opium, manufactured	$4	$4	$4
Morphine	$3 per oz.	$3 per oz.	$3 per oz.
Cocaine	$2 per oz.	$2 per oz.	$2.60 per oz.
Perfume materials, synthetic	20%	35%	45%
Perfumery, alcoholic	40c.+60%	40c.+60%	40c.+60%
Perfumery, non-alcoholic	60%	60%	60%
Floral waters	20%	20%	20%
Bay rum	$1.75 per pr.	40c.+60%	40c.+60%
Paris green	Free gal.	15%	2c.
Phosphorus	Free	10c.	8c.
Paints, artists'	20%	25%	30%
Paints and pigments, n.s.p.f.	20%	25%	25%
Barytes, crude	15%	$4 per ton	$5 per ton
Barytes, ground	20%	$7.50 per ton	$10 per ton
Prussian blue	20%	12c.	8c.
Ultramarine	15%	3c.	4c.
Bone black	15%	20%	1c.
Chrome colors	20%	25%	30%
Gas black	15%	20%	30%
Litharge	25%	2½c.	2½c.
Orange mineral	25%	2½c.	3c.
Red lead	25%	2½c.	2½c.
White lead	25%	2½c.	2½c.
Ochers, siennas, umbers	5%	½–1c.	½–1c.
Satin white	20%	½c.	½c.
Spirit varnishes, denatured	10%	25%	35c. per gal +35%
Spirit varnishes, not denatured	$1.32 per gal.+35%	$2.20 per gal.+25%	$2.20 per gal.+35%
Vermilion reds	15%	33c.	26c.
Zinc oxides	10%	1½c.	1½c.
Zinc oxides, in oil	15%	2c.	2½c.
Lithopone	15%	1½c.	1½c.
Potassium chromate	1c.	2½c.+15%	2½c.+15%
Potassium dichromate	1c.	2½c.+15%	2½c.+15%
Potassium chlorate	½c.	1c.+15%	1c.+15%
Potassium ferricyanide	2c.	7c.+15%	7c.+15%
Potassium ferrocyanide	1½c.	4c.+15%	4c.+15%
Potassium iodide	15c.	25c.+15%	25c.+15%
Potassium bicarbonate	½c.	40%	1½c.+15%
Potassium bromide	15% n.s.p.f.	10c.+15%	8c.+15%
Potassium carbonate	Free	40%	½c.+15%
Potassium hydroxide	Free	40%	1c.+15%
Potassium nitrate	35c.	40%	½c.+15%
Potassium permanganate	1c.	40c.	4c.+15%
Santonin	Free	75c.	75c.
Soap, castile	10%	15%	15%
Soap, toilet	30%	30%	10-30%
Soap, all others	5%	20%	5%
Sodium arsenate	Free	1c.	1c.
Sodium bicarbonate	½c.	½c.	½c.
Sodium borate	½c.	½c.	½c.
Sodium bromide	15% n.s.p.f	10c.	8c.
Sodium carbonates	Free or ½c.	½c.	½c.
Sodium chlorate	½c.	1½c.	1½c.
Sodium chloride, bags	Free	0.11c.	0.2c.
Sodium chloride, bulk	Free	0.7c.	0.16c
Sodium chromates	½c.	1½c.	1½c.
Sodium formate	15% n.s.p.f.	25%	1c.
Sodium ferrocyanide	½c.	2c.	2c.
Sodium hydroxide	½c.	½c.	½c.
Sodium nitrite	½c.	3c.	3c.
Sodium phosphate	½c.	½c.	½c.
Sodium sulphate, crystals	Free	5c.	5c.
Sodium sulphate, anhydrous	Free	10c.	10c.
Sodium sulphide	½c.	½–1c.†	½–1c.†
Sodium silicate	Free	½c.	½c.
Sodium sulphites	½c.	½c.	½c.
Sodium hydrosulphite	15% n.s.p.f.	35%	35%
Sulphoxylates	15% n.s.p.f	35%	35%
Starch, potato	1c.	1½c.	2c.
Starch, all other	½c.	1c.	1c.
Dextrine, potato	1½c.	1½c.	1½c.
Dextrine, all other	½c.	1½c.	1½c.
Strontium salts	15% n.s.p.f.	25%	50%
Strychnine	Free	15c. per oz.	15c. per oz.
Thorium nitrate	25%	25%	45%
Tin compounds	10%	20%	25%
Titanium compounds	15% n.s.p.f.	25%	5c.+25%
Vanilla beans	30c.	30c.	30c.
Tonka beans	25c.	25c.	25c.
Zinc chloride	½c.	1 7/10c.	1 7/10c.
Zinc sulphate	½c.	½c.	½c.
Zinc sulphide	15%	1½c.	1½c.
petroleum, crude	Free	Free	Free
fuel oil	Free	Free	Free
CHEMICALS ON THE FREE LIST			
Chromic acid	Free	Free	Free
Hydrofluoric acid	Free	Free	Free
Hydrochloric acid	Free	Free	Free
Nitric acid	Free	Free	Free
Sulphuric acid	Free	Free	Free
Cinchona bark	Free	Free	Free
Calcium acetate	Free	Free	Free
Calcium chloride	Free	Free	Free
Calcium nitrate	Free	Free	Free
Calcium cyanamide	Free	Free	Free
Coal-tar crudes	Free	Free	Free
Copper sulphate	Free	Free	Free
Copper acetate	Free	Free	Free
Crude drugs	Free	Free	Free
Enfluerage grease	20%	Free	Free
Floral essences	20%	Free	Free
Ferrous sulphate	Free	Free	Free
Iodine, crude	Free	Free	Free
Monarite sand	25%	Free	Free
Oils, essential	20%	Free	Free
Potash salts, crude	Free	2½c.††	2½c.††
Quinine	Free	Free	Free
Sodium nitrate	Free	Free	Free
Sodium sulphate, crude	Free	Free	Free
Sulphur	Free	Free	Free
Pyrites	Free	Free	Free

* Not specially provided for.
† Depending on strength.
†† For two years: 2c. for third, 1½c. for fourth, 1c. for fifth, thereafter free.

many. Your committee has reached the conclusion that no rates in American tariff history would be adequate to protect this industry.

Your committee therefore recommends that the provisions of the emergency tariff act relating to dyes and synthetic organic chemicals be extended for a period of 1 year after the tariff bill becomes a law. The President is also authorized, if upon investigation he ascertains that the rates specified upon coal-tar intermediates and dyes do not equalize the differences in competition here and abroad, or if he ascertains that an industry in the United States is being or is likely to be injured by reason of the importation of like intermediates or dyes into the United States, to issue a proclamation stating such fact and to continue the dye and chemical control act in force for a further period not to exceed 1 year. In addition, the following rates of duty on these products are proposed: 50 per cent plus 7 cents per pound on intermediates and 60 per cent plus 7 cents per pound on finished coal-tar products.

Under the administrative provisions previously referred to, the President is given authority to change the basis of these rates to the American values of similar or competitive articles and also to increase or decrease these rates as much as 50 per cent if such action is found to be necessary. The extension of the dye control provisions for 1 year, or 2 years if necessary, will give the President ample time to investigate conditions in the dye industry and to ascertain what changes in rates and methods of valuation are necessary in order that all branches of the organic chemical industry may become firmly established in the United States.

The inequalities between the rates on citrate of lime and citric acid were adjusted by increasing the duty on citric acid from 12 to 18 cents per pound and decreasing

the rate on citrate from 7 cents to 6 cents per pound. The duties on lactic acid and oxalic acid have been increased considerably over those in the House bill. The rates on butyl alcohol and competitive products were more than cut in half by the Senate Finance Committee. Both crude and ground barytes received substantial increases and additional compensatory duties were imposed on the various barium chemicals. In the case of mercurials, too, it was necessary to increase the duty in order to compensate for the increase in the rate on quicksilver, which had been changed on the floor of the House. The duty on chalk was radically increased—from 15 to 35 per cent—presumably to take care of the highly purified, chemically refined chalk.

Changes From Ad Valorem to Specific Duties

In a number of places throughout the chemical schedule it will be observed that specific duties were substituted for the ad valorem rates of the House bill. This was usually done in the case of definite chemical compounds in which there is but little variation in the grades or qualities ordinarily used in commerce. Another factor which no doubt prompted many of these changes was the relatively greater stability in prices at present than at the time the House bill was framed.

The duty on natural dyeing and tanning extracts has been more than doubled over that in the House draft. A new classification covering vulcanized or hard fiber has been inserted to provide for cellulose products made by treating cellulose with zinc chloride to hydrolize it and then after dehydration, molding the material by pressure. The glue and gelatin paragraph has been entirely rewritten and edible gelatin has been separated from other forms of glue and gelatin. In the case of the technical products the separation is on a price basis —the dividing line being at a value of 40 cents per lb.

Vegetable Oils

A heavy duty was placed on cottonseed, soya bean, coconut and peanut oils, but by means of an important proviso these oils can be imported duty free under bond for use in the manufacture of products unfit for food. This is practically equivalent (except in the case of peanut oil) to putting them on the free list. The duty on castor oil has been reduced and that on alizarin assistants increased from 25 to 35 per cent. One interesting and highly important change has been in the case of tapioca and sago, which were transferred from the free list and given substantial duties under the agricultural schedule.

The paragraph on soap was changed materially and the language of the old 1909 provision accepted. This provides somewhat higher duties but will also give the customs officials a chance to distinguish between "perfumed" and "unperfumed" toilet soap.

Potash and Cyanide Tariffs

Fertilizer materials remain dutiable, although the rate on ammonium sulphate was reduced from ⅝ to ¼ cent per pound. Chilean nitrate, however, continues on the free list. The sliding scale of duties on crude potash salts—viz., 50 cents per unit for the first 2 years, 40 cents for the third, 30 for the fourth, 20 for the fifth, and thereafter duty-free—was continued in the Senate bill, although a number of slight reductions were made among the refined potassium salts.

The results of one of the most interesting of the tariff battles in the chemical schedule is found in the new paragraph 33a, which provides a 10 per cent duty on potassium and sodium cyanides. This may be said to represent a compromise between the demands of the domestic producers and those of the important consuming interests.

Paragraph 5, the important "catch-all" or "basket" clause of the chemical schedule, which includes "all chemical elements, salts and compounds" not elsewhere specially provided for, carries a duty of 25 per cent ad valorem. This is the same as in the Payne-Aldrich tariff of 1909 and is an increase of 5 per cent over the rate in the corresponding paragraph of the 1913 tariff.

Research Develops New Concept of Soils

Investigations by the Bureau of Soils of the Department of Agriculture have resulted in the announcement of an interesting new conception of the nature of soils. A colloidal material, quite different in nature from the mineral particles and organic matter which are generally believed to make up the whole of the soil, has been isolated from a number of different soils and has been dubbed "ultra clay." It seems to constitute a fundamental part of the soil. Studies of the behavior and properties of the colloidal particles that make up this ultra clay are giving a new concept of the soil, and it is predicted that these researches will throw fresh light on many soil problems.

Ultra clay is described as a gelatinous material which shrinks greatly on drying and has a high absorptive power for water, ammonia, salts and dyes. At the proper moisture content it may have a binding power far greater than portland cement. At other moisture contents it is highly plastic. In short, this material has in an exaggerated degree most of the properties characteristic of the soil as a whole.

Chemically, ultra clay appears to be chiefly a gelatinous silicate of aluminum with varying amounts of ferric hydroxide, silicic acid, aluminum hydroxide and organic matter, in a colloidal condition. These substances exist in such a fine, or colloidal, state of subdivision that when the material is shaken up with water a permanent, opalescent suspension is obtained and many of the individual particles appear under the ultramicroscope only as points of light in active motion. In the presence of certain salts the colloidal particles coagulate, forming large aggregates which readily settle out.

The Electric Resistance Furnace in an English Brass Foundry

A month's test was recently conducted to determine the utility of a Baily 1-ton nose-tilting type furnace in one of the oldest brass-rolling mills in England. The test charges consisted of cartridge shells and rolling mill scrap, pouring 60-40 brass into round billets, strip molds and condenser plates.

In the test on round billets, 3 in. to 6 in. in diameter, operating the furnace continuously for thirty-one heats, 50 hours was consumed in melting and a total of 48,608 lb. of brass was poured. The electrical energy consumed was 306 kw.-hr. per ton of metal melted.

With a similar charge of cartridge shells and rolling mill scrap pouring 60-40 brass into condenser plates weighing 1,700 lb. each eighteen heats required 31 hours and 49 minutes. The total metal melted was 30,744 lb. at an energy consumption of 276 kw.-hr. per ton of metal melted.

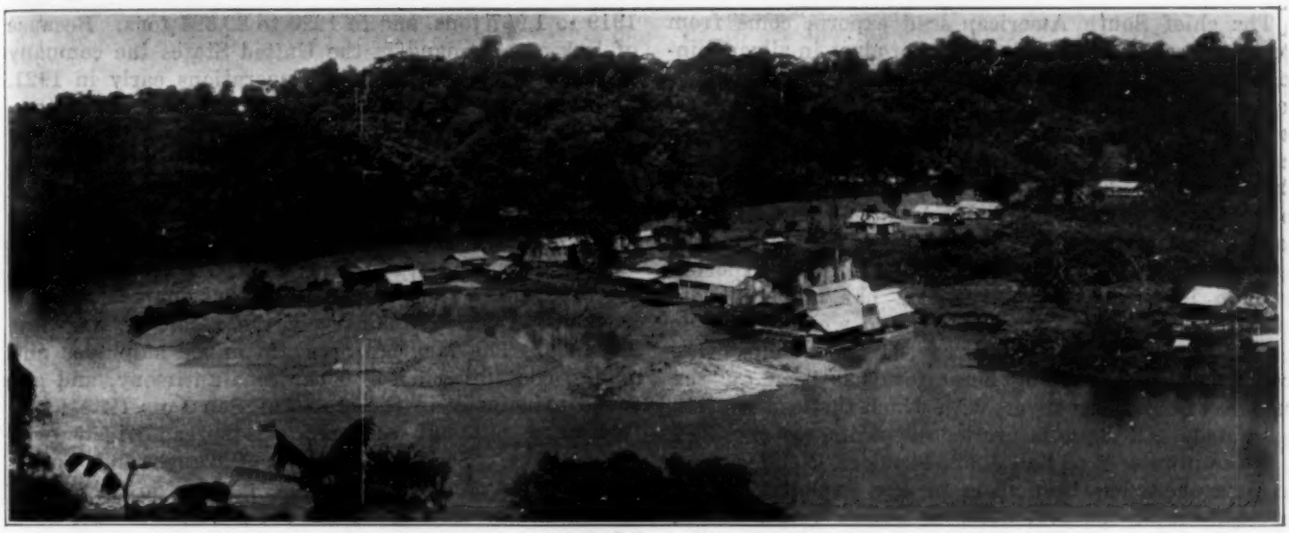


FIG. 19—PLATINUM MINING TOWN OF ANDAGOYA AT CONFLUENCE OF SAN JUAN AND CONDOTO RIVERS IN COLOMBIA

Minerals, Earths and Clays of Latin America—III

A Review of Some Latin-American Resources, Many of Which Await Commercial Development—Platinum in Colombia, Lead in Mexico, Bismuth in Bolivia, Monazite Sand in Brazil, Asphalt in Trinidad, Sulphur, Borax, Precious Stones and Other Important Mineral Products*

BY OTTO WILSON
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IN 1914, when the outbreak of the European war practically shut off the Russian exportation of platinum, the chemical industry and other platinum users of the world turned to the second most important source, the Republic of Colombia. These two countries have furnished practically the world's supply of platinum—Colombia before 1914 being a distant second to Russia, supplying only 6,000 to 15,000 oz. out of a total of 250,000 to 300,000 oz. With the Russian output greatly curtailed, Colombia's proportion, as well as the actual amount produced, increased rapidly. In 1917 the estimated production of Colombia was 32,000 oz. and that of Russia 50,000; in 1918 the figures were 35,000 oz. for Colombia and 25,000 for Russia; in 1919 Colombia produced about 35,000 oz. and Russia 30,000; and in 1920 the two countries were about equal with 35,000 oz. each. These figures, of course, especially as regards Russia, represent only broad estimates.[1] Our imports from Colombia in 1920 were 29,853 oz., and in 1921 31,840 oz. There is reason to believe that with more intensive mining operations the South American country may in time lead the world as a platinum producer, even with a normal Russian output.

Colombian platinum is derived entirely from placer operations in the sands and gravel of the rivers of the western part of the country, from the Ecuadorian border to the headwaters of the Atrato River. The principal stream, so far as known deposits are concerned, is the Condoto River, a tributary of the San Juan. Most of the platinum has heretofore been recovered by natives, but dredging operations, backed by extensive British and American capital, are now being carried on. The South American Gold & Platinum Co. has two dredges working on the Condoto River, and is preparing a third which will be larger than either. One of the dredges produced 6,349 oz. in 10 months in 1919, and in the first 8 months of 1920 worked at a still better rate. The British Platinum & Gold Corporation also has a dredge on the Opogodo River of the San Juan basin. Colombian platinum as it reaches the market consists of 80 to 85 per cent of platinum, a higher proportion than the average, the remainder comprising other metals of the platinum group, notably osmium and iridium.

The platinum deposits are said to extend over the border into Ecuador, but apparently the metal, which is found associated with gold, is not found in important quantities in that country. On the island of Chiloe, off the mainland of Chile, beach deposits of black sand are reported to contain some platinum, but in amounts too small to be profitable so far as present discoveries have disclosed.

Lead and zinc are scattered over many countries of South America, and are smelted in many of them, as also in Mexico. The output of lead (metric tons) in South America and Mexico in recent years has been:[2]

	1913	1914	1915	1916	1917	1918	1919	1920
South America..	2,729	3,145	4,667	4,267	4,571	5,268	7,234	5,518
Mexico.....	62,000	23,598	31,384	19,966	46,612	88,503	78,645	84,200

*For Parts I and II, which discuss other mineral resources of these countries, the reader is referred to CHEM. & MET. ENG., vol. 26, Nos. 14 and 15, pp. 631 and 697, April 5 and 12, 1922.

[1]The U. S. Department of Commerce gives the following as a Russian estimate of production in recent years: 1914, 156,960 troy oz.; 1915, 108,489 oz.; 1916, 78,997 oz.; 1917, 98,483 oz.; 1918 (to July 1), 13,166 oz.

[2]Amer. Bur. Metal Statistics Year Book, 1920.

The chief South American lead exports come from Peru, where it is obtained as a byproduct in silver mining or from the ancient slag of the Cerro de Pasco copper mines, which formerly produced silver. The total represents scarcely a third of 1 per cent of the world's output. In the neighboring country of Bolivia there is also a small production, the exports running from 1,000 to 3,000 tons a year. The ore is galena and the only field worked is near the town of La Quiaca, on the Argentine border. This ore is generally exported through Buenos Aires. Argentina has numerous deposits of lead in the same districts in which copper is found; in fact, the sulphides of the two metals often occur together. Working heretofore has been for the purpose of obtaining silver, with which the lead is often associated. All deposits are lode deposits.

In the provinces of San Juan, Mendoza, Neuquen and Cordoba there has been more or less exploitation and development of the argentiferous galena veins, but in other provinces containing apparently abundant deposits, among which are Salta and Jujuy, there has been little production. Lead has been reported from several localities in Brazil; Chile has a small output from the silver mines; Colombian lead ores have been found in the departments of Caldas, Santander, Boyaca and Cundinamarca, and Venezuela has lead deposits in the states of Lara and Tachira. Galena deposits in the State of Minas, Uruguay, have been worked occasionally.

Zinc in the form of sphalerite is associated with lead and other ores in several countries and large deposits are said to exist in the Yauli district in the Province of Junín in Peru. The general lack of transportation facilities, however, has prevented development or active interest in most of these sources.

Mexico has extensive deposits of both lead and zinc. Lead smelting is an important industry, particularly in the Monterey district, and the annual pig-lead production of 50,000 to 125,000 tons makes Mexico one of the notable sources of the world's lead supply. The chief states producing lead are Chihuahua, Durango, Sonora, Nuevo Leon, Coahuila, San Luis Potosi and Zacatecas. There is apparently a large potential output of zinc in Mexico, and in the Piedras Negras district, when prices are favorable, production of calamine ore is carried on at the rate of 10,000 tons a month. The total Mexican production in recent years has been at the rate of 11,000 to 45,000 tons a year.

In Central America, Guatemala has deposits of lead, zinc and copper near Concepcion, and the International Railways has shipped several hundred tons of calamine ore and lead carbonates, together with concentrates.

Bauxite Deposits in the Guianas

While Brazil is said to have deposits of ferruginous bauxite among the surface iron ores of Minas Geraes, and occurrences are reported in Venezuela, Colombia and Ecuador, the only section of Latin America where the mineral is known to exist in large quantities is the Guianas. Because of lack of settlement and of transportation facilities the beds have not been fully mapped out, but they are said to be of great extent, and a former Governor of British Guiana has declared that the deposits of that colony are probably the largest in the world. The alumina content is very high, analyses showing over 60 per cent. The work of exploiting these deposits was begun in 1918, but during the war there was little activity. In 1917 shipments from British Guiana amounted to 2,070 tons, in 1918 to 4,266 tons, in 1919 to 1,967 tons, and in 1920 to 29,394 tons. Because of lack of a demand in the United States the company working the deposits stopped operations early in 1921. Shipments for the first 5 months of 1921, had, however, amounted to 10,545 tons, against 2,982 tons in the previous year.

Antimony From Mexico, Bolivia and Peru

Mexico, Bolivia and Peru have a place among the antimony-producing countries of the world, but only the first named ranks as an important source. Mining in South America was largely the result of war-time demands. The Mexican ores are mixed sulphides and oxides, containing 5 to 50 per cent antimony, and are found principally in the states of San Luis Potosi and Queretaro, although occurrence is spread widely over the country. Sonora, Guerrero, Durango and Lower California, among other states, have deposits of unknown extent. Production in 1917 is stated to have been 2,646 tons; in 1918, 3,278 tons; in 1919, 470 tons; and in 1920, 1,572 tons.

The Bolivian ore is of high grade, running over 50 per cent antimony, but the visible supply is said to be limited. The country is not an important prospect for the future, although war-time shipments were heavy, rising to 27,414 tons of ore in 1916, valued at $6,614,000. The chief producing district is in the southern part of the Department of Potosi. The Peruvian output has come mostly from the Department of Puno, although Cajamarca, Huanuco, Junín and other departments have deposits and Jeru is considered a source of possible future importance. The ore worked has averaged about 60 per cent antimony. Chile reports native antimony and stibnite in the states of Trujillo and Lara, but there has been no particular development in either country.

Bismuth and Quicksilver

The world's chief source of bismuth is Bolivia, where the ore, consisting of both native bismuth and the sulphide, is found associated especially with tin deposits and also with silver and copper. Production comes mainly from mines at Tasna, Chorolque and Huayna Potosi. Since 1914 exports of bismuth have ranged between 350 tons and 680 tons, valued at $850,000 to $1,600,000. Peru has a single mine, in the Department of Junín, whose reserve is said to be sufficient to supply the world for many years. The ore consists of oxidized bismuth compounds, averaging 3 per cent bismuth. In Chile bismuth has been reported from the Province of Atacama, as a sulphide. In Brazil it occurs

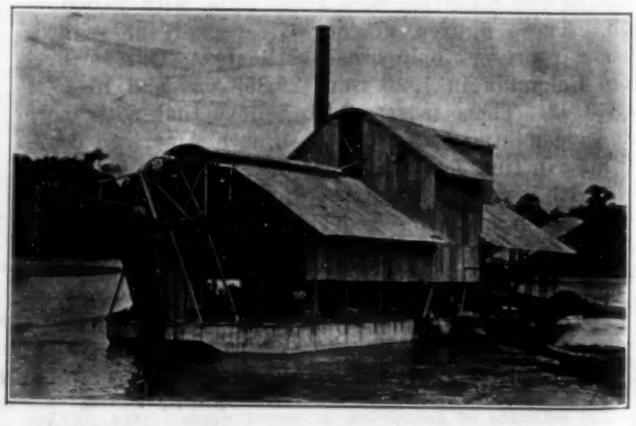


FIG. 20—DREDGE OPERATING IN THE CONDOTO

in the gold mines of Minas Geraes, both as native bismuth and the oxide, and is reported from the State of Rio Grande do Sul. The State of Lara, in Venezuela, has bismuth deposits.

Mercury has been found in several countries—Mexico, Peru, Bolivia, Argentina, Colombia, Chile, Brazil and Dutch Guiana—but in modern times only in the first two has much attention been given to production. The Peruvian mine at Huancavelica was opened about 1566 and the deposits have been worked, though not continuously, since that time. The ore is said to contain an average of 2 per cent mercury. In recent years mining has been suspended, but the owner, a Peruvian, is preparing to reopen the mine, and is driving a 4,000-ft. tunnel and has built two small furnaces. In Dutch Guiana floats of quicksilver are reported from near Marowyne River, and cinnabar is reported in place in one locality. The mines of Mexico, in San Luis Potosi, Guerrero and Durango are producing considerable amounts of quicksilver, the production for the whole country amounting to 163 tons in 1918, 118 tons in 1919, and 77 tons in 1920.

There is no mention of the existence of radium in any Latin-American country except in Brazil, where it is recently reported that the director of a museum in Fortaleza has discovered a deposit of radium-bearing minerals in the interior of the State of Ceara.

Important Non-Metallic Minerals

Mica.—Mica is becoming an important article of export in Brazil and Argentina, and has also been mined to some extent in Guatemala. The Brazilian mica is muscovite, of excellent quality, the masses taken out for export being mostly about 6 in. square, although much larger are often found. Production has so far been confined to four states, Bahia, São Paulo, Goyaz and Minas Geraes. São Paulo shipped 11,000 kilos in 1918. The Argentine mica is found in the Sierra de San Luis and the Sierra de Cordoba, and is said to be of good quality. The deposits are numerous and one Buenos Aires exporter has offered to furnish regular supplies up to 5 metric tons per month. The character and size of the quantities available are unknown, but shipments to Europe from Cordoba have consisted of small sizes of light brown muscovite. The Guatemalan mica is also muscovite, white, amber, green and other colors being found.

Monazite Sand.—In addition to its nitrates and other non-metallic minerals, Latin America has two rich fields, each of which is probably the most valuable of its kind in the world. These are the monazite sands of Brazil and the asphalt lakes of Trinidad and Venezuela. The invention of the gas mantle established the first commercial outlet for monazite, since this mineral is the chief source of thorium and cerium salts, on which the mantles are dependent for their incandescence. Mesothorium, the radioactive element which is coming into increasing importance as a substitute for radium in the manufacture of luminous paints, is also found in monazite. The monazite of Brazil is found both along the seacoast and in the inland river beds, where the action of the water has concentrated the sands formed by the disintegration of the crystalline rocks of the coastal mountains. The occurrence of the monazite in these rocks is too rare to permit profitable working. More concentrated deposits are found at various places along the Brazilian coast between Maranhao and Rio de Janeiro, but only in the states of Bahia and Espirito Santo are they of commercial value. The federal government claims the sands on a strip 33 m. wide, measuring from mean high tide, and these are now being worked under lease. The sands are high in thoria, averaging 4 to 6 per cent, and they can therefore be worked while deposits in our own country lie idle because of low prices. The beach reserves are estimated at 15,000 to 20,000 tons of concentrates. The inland streams apparently furnish the real reserve, the river beds of Minas Geraes, Espirito Santo and Rio de Janeiro having gravels that would probably yield 200,000 tons of monazite. In the last few years exports have gone wholly to the United States, shipments amounting to 1,136 tons in 1917, 500 tons in 1918, 146 tons in 1919, and 1,153 tons in 1920.

Asphalt.—Asphalt deposits, formed by the evaporation of the volatile parts of oil rising to the surface, are found in various parts of Venezuela and on the island of Trinidad. The two great sources of the asphalt of commerce are Trinidad Lake, on the island of that name, and Bermudez Lake, about 30 miles inland on the mainland across from Trinidad. The latter is much larger, covering about 2,000 acres, compared with about 120 acres for the former, but Trinidad has been the chief source of past exports, shipments amounting to 130,000 to 230,000 tons annually as compared with 25,000 to 95,000 tons from Venezuela. Trinidad Lake goes to an unknown depth, boring being difficult because of the fact that the asphalt is in constant slow motion. A depth of 150 ft. has been achieved. Venezuela has other deposits besides Lake Bermudez, several of which have been worked. One is located as far west as the Limon River, 50 miles west of Maracaibo. Cuba and Mexico in the past have also shipped varying amounts of bituminous substances.

Graphite.—Another form of carbon, graphite, is found in several countries, including Mexico, Brazil, Chile, Uruguay and Paraguay. Mexico is one of the chief producers of amorphous graphite for the manufacture of

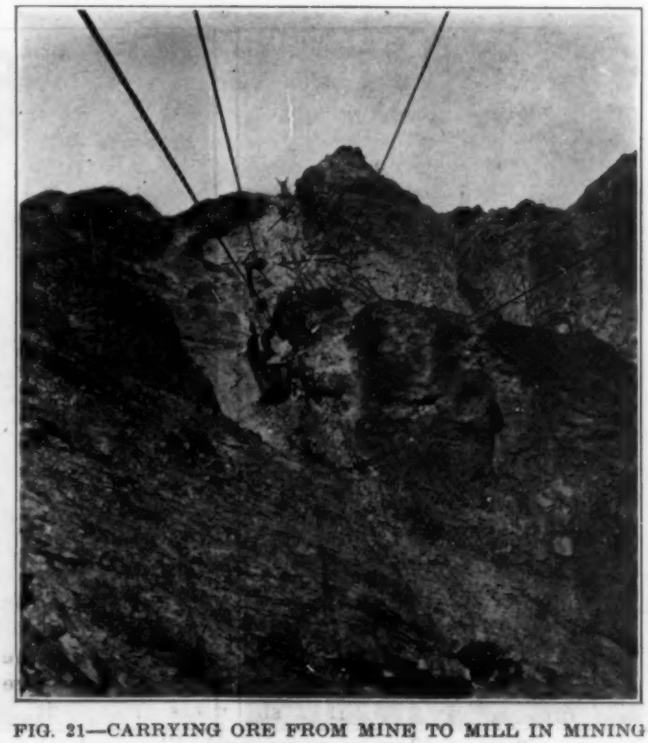


FIG. 21—CARRYING ORE FROM MINE TO MILL IN MINING DISTRICT OF PERU

pencils, and some crystalline graphite is also reported. Normal production runs for 1,000 to 3,000 tons a year, that for 1917 being 420 tons; in 1918, 6,190 tons; 1919, 4,023 tons; and in 1920, 2,991 tons. The Santa Maria mine, near La Colorado, Cordoba, is the chief producer. Brazil apparently has deposits of an excellent grade of graphite in Minas Geraes and Rio de Janeiro, and also unsurveyed deposits of flake graphite. The former has been used locally for pencil manufacture. Exports amounted to 44 tons in 1918 and 2 tons in 1919. In 1920 there were no exports. In Chile some graphite has been mined at Chehueque, Atacama, but the production has been inconsiderable.

Sulphur.—Several countries have important deposits of sulphur, which are worked for local purposes. Perhaps the most important of these are in Chile in the craters and slopes of the old volcanoes. These deposits are near the nitrate fields and are convenient for the manufacture of the black blasting powder used in nitrate working. Deposits so far worked occur in provinces of Tacna, Tarapacá, Antofagasta, Atacama and Coquimbo, the chief producing district being that of Tocora in Tacna Province. The country's production has gone as high as 10,000 tons a year. Peru has many sulphur deposits, some of them with contents running 30 to 40 per cent sulphur. Venezuela has working deposits of sulphur.

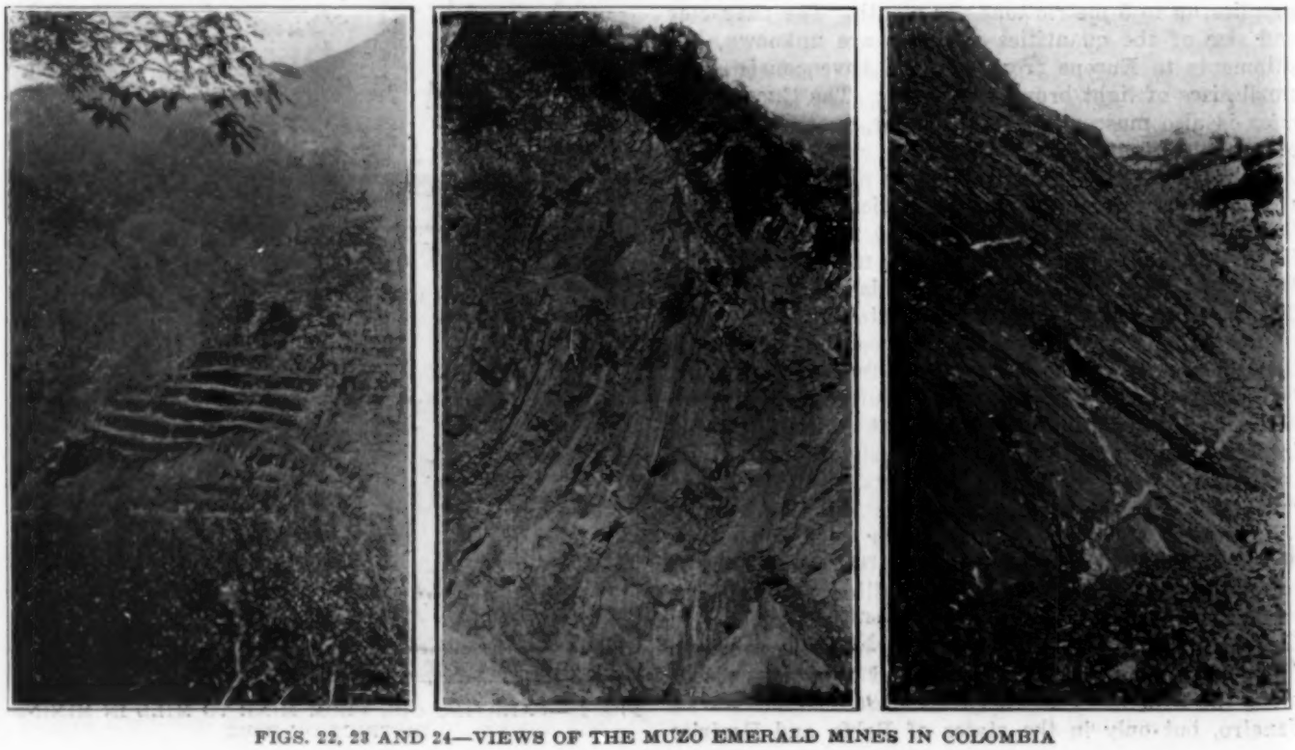
Several localities in Mexico produce sulphur, especially in the states of Durango, San Luis Potosi and Lower California. An interesting deposit worked off and on since the times of the early conquerors is that in the crater of Popocatapetl, where the supply is large, but the altitude makes exploitation expensive. Mexico also has important pyrite deposits, notably one in the State of Guerrero of several million tons, containing 48 per cent sulphur, but there is no production of importance. Cuba has a pyrite deposit near Cienfuegos, and the Andean countries and Brazil, in South America, report its presence in association with more important metals.

Borax.—Chile, Peru, Bolivia and Argentina are the borax countries of South America, the desert regions of northern Chile and one deposit near Arequipa, Peru, being the chief sources. The borates are found in the beds of dried-up lakes called *salares*, some of which contain millions of tons of crude borax. Because of transportation costs very few of these are worked, Chile's production of 40,000 tons annually coming almost entirely from the Saler de Ascotan in Antofagasta. Borax Consolidated, Ltd., a large British company, controls the industry in Chile, Bolivia and Peru, and it can increase its output to take care of any possible demand. The Argentine deposits are in the provinces of Los Andes, Jujuy, Salta and Catamarca. Those worked commercially contain 25 to 40 per cent of boric acid. The sun-dried product runs 38 to 50 per cent anhydrous boric acid. Several hundred tons is mined yearly for local and export purposes, but lack of fuel and transportation facilities makes more extended production unprofitable.

Rock Phosphate.—The chief Latin-American contribution to the world's supply of phosphate rock comes from the Dutch islands of Aruba and Curacao, off the coast of Venezuela. Normally there is a large exportation to Europe. Islands off the coast of French Guiana also export phosphates. Chile and Peru have worked deposits.

Potash.—Chile is the only country having potash deposits of importance, and the industry in that country has not been devoloped. The potash occurs in the *salares*, the two chief ones being the Salar de Pintados and the Salar de Bella Vista, in Tarapaca. Chilean chemists have estimated that these deposits contain over 2,000,000 tons of potash. They are of low grade, however, containing 10 to 15 per cent potassium sulphate (or chloride) and it is yet uncertain whether they can be worked profitably.

In addition to these separate deposits it has been found that some sodium nitrate deposits contain a certain amount of potassium nitrate, and the du Pont com-



FIGS. 22, 23 AND 24—VIEWS OF THE MUZO EMERALD MINES IN COLOMBIA

pany has recovered over 1,000 tons a year of potash in the form of the nitrate. It is claimed that if the du Pont process of separating the potassium from the sodium nitrate were followed at all the nitrate plants, over 100,000 tons of potash could be recovered annually.

Other Undeveloped Possibilities

Other non-metallic minerals are found scattered here and there and give evidence of what may be expected in the way of future development of Latin America's mineral wealth. Magnesite is produced in limited quantities on the island of Margarita, in Magdalena Bay, Lower California, where large quantities in canyon walls and stream beds are reported to be available without mining, and also in Margarita Island, Venezuela, where the ore is of the white amorphous type and occurs in very large deposits. Shipments from both these countries to the United States have been made regularly for several years. Fluorite has been found in many places in Mexico, but has been mined commercially in only one, a rich deposit located near Guadalcazar, in San Luis Potosi. Other deposits promise to become profitable; one of green fluorite in the town of Chalchihuites, in Zacatecas, has been worked to a certain extent. In Córdoba, Argentina, veins of fluorite occur in bands that are colorless, light green, yellow, violet, blue or almost black. Alum and soda are found in the old volcanos in Los Andes, Argentina. Large quantities of alum occur in two craters as clean white compact masses of mixtures of aluminum and magnesium sulphates containing about 20 per cent aluminum sulphate. Mexico is a considerable producer of white arsenic, the output being 2,246 tons in 1919 and 2,183 tons in 1920. The Mapini smelter owned by the American Metal Co. (Ltd.), has a plant with a normal annual capacity of 5,000 tons.

Chile is, of course, the world's largest producer of iodine, which is obtained as a byproduct of the nitrate industry. The largest year's output in recent times was 1,500 tons in 1916, an amount which could if necessary be greatly increased. Asbestos has been reported from Brazil and Uruguay, but apparently the deposits are of no commercial value.

Building stone is plentiful throughout Latin-American countries, but that of Uruguay is perhaps most ornate and best known. The quarries yield both marble and granite, the former ranging through many colors, white, red, pink, gray, black and banded, and providing excellent material for either building or statuary. A number of granite quarries are active, much of the granite being of high grade. Slates of a beautiful color and toughness, very suitable for roofing, are quarried in Uruguay for local purposes. Another notable product of that country found near Conchillas, in Colonia, is a very fine grade of talc which is of such purity that it is used for pharmaceutical purposes as well as in various industries.

Precious Stones

In precious and semi-precious stones Latin-American countries exhibit a wide range. Brazil and the Guianas are well known for their diamonds. Colombia is one of the chief emerald producers of the world. Pearl fishing has for centuries been an important industry of the Caribbean waters off the coast of Venezuela, and in the Pacific along the coast of Mexico, Nicaragua, Costa Rica and Panama. Mexico is famous for its opals. Uruguay has amethysts, agates and other semi-precious stones, and Venezuela has opals, amethysts and garnets.

Distribution of Petroleum Refineries in U. S.

Petroleum refineries in the United States on January 1, 1922, numbered 479 completed plants, with 30 additional plants in process of construction, according to a statistical summary prepared by H. J. Lowe, petroleum economist of the Federal Bureau of Mines. The indicated daily refining capacity of these plants is 2,164,050 barrels of crude oil.

The tremendous increase in the extent of the petroleum refining industry of the country is shown by the fact that in 1914 but 176 petroleum refineries had been completed. Within eight years the number of refineries has been increased by 172 per cent.

Texas at present leads all other states in the volume of oil refining business, with 63 operating plants, with a daily capacity of 345,150 barrels; in addition, the state had on January 1, 46 refineries in shut-down condition, while 9 other plants were being built. Oklahoma is the second state in number of refineries, with 54 operating and 43 shut down; operating plants in this state had a daily capacity of 234,650 barrels. California, with 34 operating plants, was refining 314,360 barrels daily. Pennsylvania had in operation 48 plants, with a daily refining capacity of 114,930 barrels. New Jersey, with but 5 refineries, treats 224,000 barrels of oil daily.

The importance recently attained by the State of Louisiana in this country is indicated by the fact that 14 refineries were treating 114,350 barrels daily, while 11 plants were in shut-down condition. Kansas, with 19 operating plants, was refining 57,650 barrels daily; Illinois, with 12 plants, was handling 62,050 barrels; Wyoming, with 11 plants, was refining 89,900 barrels; and Indiana, with 5 plants operating, was handling 54,300 barrels daily.

Of the 479 completed refineries in the United States, 154 were in shut-down condition at the first of the year. The daily refining capacity of these non-operative plants was 254,610 barrels, or approximately one-eighth of the entire refining capacity of the country. The 30 new plants in process of construction will, it is estimated, add 59,950 barrels to the country's daily refining capacity.

Need for Standardization of Mineral Fillers and Paving Blocks

The broad field of mineral fillers is sadly lacking standardization, according to Oliver Bowles, mineral technologist of the Bureau of Mines. Many users of mineral materials have very indefinite knowledge of their requirements either in color, grain size, grain shape or chemical composition. The standardization of fillers is practically an untouched field, and such standardization accomplished through a comprehensive study of the subject would not only promote better manufacturing processes but would be of material benefit to producers. It is claimed by one producer that the cost of purchasing special screens to satisfy the requirements for odd sizes for one customer destroys most of the profit obtained from grinding roofing grade talc.

Granite paving blocks are manufactured in a great variety of sizes, says Mr. Bowles. Eleven varieties, sold under trade names, were reported in 1917, and many other varieties were sold by sizes only. The State of Maine reported seven different sizes, New York seven, Massachusetts ten and other states a varying number. Undoubtedly some latitude should be permitted in paving block dimensions, particularly in length, but too great complexity is involved when every state or city writes its own specifications.

Aluminum-Silicon Alloys

Aluminum-Silicon Alloys Long Known Are Coming Into Use Because of Superior Casting Qualities—Unique Structural Change Brought About by Treatment of Molten Alloy Improves Physical Properties of Castings—Technical Properties of Alloys Described

BY ZAY JEFFRIES
Research Bureau, Aluminum Co. of America

IN VIEW of the fact that aluminum-silicon alloys are now being used to some extent commercially, it is believed that a brief account of their history and characteristics will be of interest to aluminum founders and users of aluminum alloy castings.

EARLIEST RECORDS

In *Comptes rendus*, vol. 42, p. 49 (1856), is found an account of what appear to be the first alloys of aluminum and silicon, prepared by H. St. Claire Deville and independently by Wöhler. Aluminum-silicon alloys can be prepared in a number of ways. One method described by Wöhler is to fuse a mixture of aluminum and an excess of the double fluoride of potassium and silicon at a temperature above 950 deg. C. in an ordinary crucible. After cooling, there is found in the midst of the fused salt an alloy of aluminum and silicon which contains varying amounts of silicon, depending upon the duration of the heating. Alloys of this nature were used for the purpose of producing pure silicon. This was accomplished by dissolving the aluminum with hydrochloric acid, nearly pure silicon remaining as a residue. In a book "Aluminum and the Alkali Metals" by Charles and Alexander Tessier (1858) the authors state, "As Deville has correctly observed, silicon does not destroy the malleability of aluminum as iron and copper would do." The authors state that the alloy they experimented with contained at least 10 per cent Si.

A rather extensive investigation of aluminum-silicon alloys was made by Adolphe Minet in the early '90s. In a note published in *Comptes rendus*, 1891, p. 1215, he gives the analyses and tensile properties of several aluminum-silicon alloys and aluminum-silicon-iron alloys, in both the cast and forged condition. The alloys were prepared by electrolysis, using a bath composed of sodium chloride (60 parts) and double fluoride of sodium and aluminum (30 parts), to which was added at the moment of fusion alumina (5 parts) and silica (5 parts). He makes the following comment on the tensile results: "The alloys rich in silicon, such as those which contain 8.9 per cent of this metalloid, possess tensile properties superior to those of pure aluminum."

In vol. 1, p. 10, of the *Journal de l'Electrolyse* (1895) results of tests on a large number of Minet's aluminum-silicon alloys are given. One alloy containing 89.8 per cent Al, 1.57 per cent Fe, 8.9 per cent Si, had a tensile strength of 24,300 lb. per sq.in. and elongation of 2.85 per cent as cast. The same alloy in the rolled condition showed a tensile strength of 27,950 lb. per sq.in. and elongation of 9.18 per cent. In this article the following comment is found: "The presence of silicon in aluminum, contrary to the ideas generally spread since Henry St. Claire Deville, does not injure the mechanical properties of aluminum; on the contrary, it gives to it greater hardness and strength without destroying its malleability, and this up to a content of about 10 per cent. Iron, on the contrary, is a harmful element; however, up to a content of 1.25 per cent it increases the strength of aluminum."

The following is quoted from Prof. J. W. Richards' book on "Aluminum," third edition (1896), p. 518: "A small amount of silicon does not appear to be very injurious to the malleability of aluminum, which bears it much as iron and copper do, but over 1 or 2 per cent commences to change its color, makes it harder and especially crystalline so that its malleability is rapidly impaired. The silicon, however, may be present up to even 5 per cent without preventing the use of the metal for castings and articles not to be worked.

"Minet has proved that aluminum may contain even 8 per cent Si and yet be quite strong if the amount of iron present is small; but as the iron increases over 1 per cent the metal becomes worthless."

STUDIES ON THE CONSTITUTIONAL DIAGRAM

The first work of consequence on the constitution of the aluminum-silicon alloys is reported by Vigoroux and Arrivaut in "Procès-verbaux de la Société des sciences physiques du Bordeaux," Nov. 21, 1901. Micographs of samples containing 45.5, 25.35, 14.82 (Fig. 1 herewith) and 4.81 per cent Si are given. The authors would place the eutectic composition between 14.82 and 25.35 per cent Si, since their micrographs clearly show excess aluminum in the former and excess silicon in the latter. However, they did not attempt to construct a constitutional diagram.

"Mechanical alloys" of aluminum and silicon are described by Guillet, "Etude Industrielle des Alliages Metalliques," (1906), vol. 1, p. 965, and also in Kent's Mechanical Engineers' Hand Book, 9th edition, p. 398. The following is taken from Guillet: "Among the alloys of aluminum, the ones such as ferro-alumium, ferrosilicon-aluminum and silicon-aluminum, where the silicon is above 10 per cent, are employed in metallurgy. The others, in which the silicon is below 10 per cent, can be employed for mechanical purposes in place of steel on account of their high strength and their lightness." Types are described as follows:

Types	Al	Fe	Si
1	92	1.25	6.75
2	90	0.75	9.25
3	90	trace	10.0

"The highest strength has been obtained with the alloys in which the proportion of iron is quite low and that of silicon about 10 per cent. Above that amount the alloys are crystalline and not of much use. The density of the alloys of silicon is about that of aluminum."

In *Zeitschrift für anorganische Chemie*, vol. 58, p. 154 (1908), W. Fraenkel gives the first constitutional

diagram of the aluminum-silicon alloys. He reports that the alloys form a eutectiferous system with no chemical compounds. The eutectic alloy contains about 90 per cent Al and 10 per cent Si and freezes at a temperature of about 576 deg. C. The alloys were prepared by melting together commercially pure aluminum and Kahlbaum silicon. In *Revue de Métallurgie*, vol. 8, p. 457 (1911), Frilley describes the results of experiments on aluminum-silicon alloys. He calls attention to the harmful effect of high iron on the aluminum-silicon alloys, both as regards the effect on tensile properties and corrosion. He describes an alloy containing 89.18 Al, 10.07 Si and 0.75 Fe as "brilliant crystalline, fusible; can be forged cold." Frilley made aluminum-silicon alloys both by melting mixtures of the two metals and by reducing the oxides of the two metals simultaneously in the electrolytic cell. He states: "All of these [above] alloys were prepared, as we have said, by fusion of aluminum and silicon. It is entirely rational to assume that the results found might be entirely different, if we were able, under other conditions, to bring together some silicon and aluminum for instance in the nascent state, to use an obsolete expression. Now this is precisely what takes place in an electric furnace producing aluminum by electrolysis, and it has been proved that the silicon-aluminum alloy thus obtained has very different properties from those of the metal obtained by melting together the two substances."

FIG. 1

Aluminum-silicon alloy containing 14.82 per cent Si; fine grained eutectic and excess Al. (Vigoroux). × 35.

Frilley thought that the simultaneous electrolytic production of aluminum and silicon in the form of an alloy might produce a definite compound of aluminum and silicon, not producible except by electrolytic means. He concludes his paper as follows: "In the actual state of our knowledge, we are no better able to produce it than we are able to produce electrolytic silicon, but, as we said above, the problem is the same and everything predicts that on the day when such alloys are realized industry will be in the possession of metal endowed with the most interesting properties."

In 1914 Roberts (*Journal of the Chemical Society*, vol. 105, p. 1383) confirms Fraenkel's constitutional diagram. The eutectic composition was about 90 per cent Al and 10 per cent Si and the freezing point of the eutectic was about 578 deg. C. Alloys used by Roberts were made by the direct fusion of aluminum and silicon.

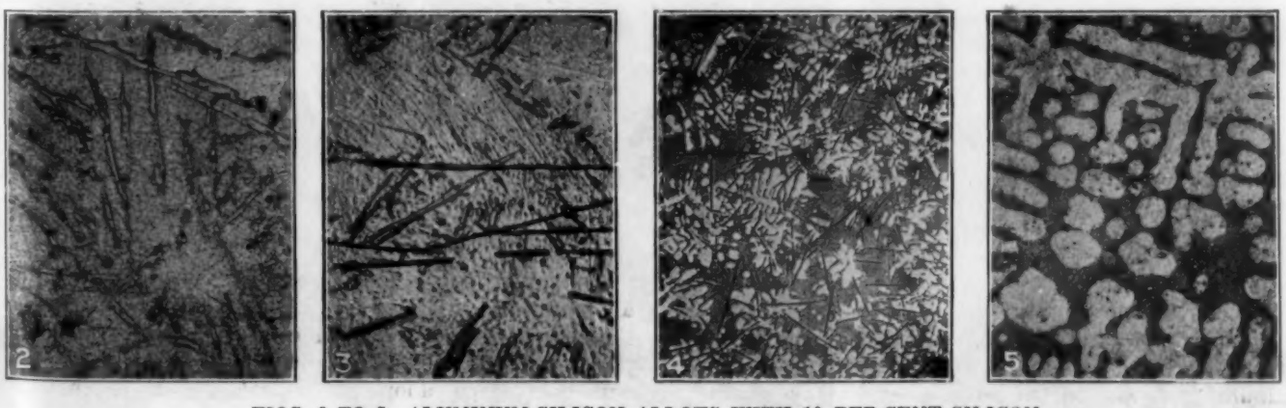
In 1915, in *Stahl und Eisen*, vol. 35, p. 875, Schirmeister describes experiments on aluminum-silicon alloys to determine the mechanical properties and resistance to corrosion. From his experiments he draws the following conclusion: "Accordingly, aluminum is in general favorably influenced by the addition of silicon, and at the same time the specific gravity is unchanged. The alloys with 5 to 7 per cent Si are best suited to rolling and with 10 to 12 per cent Si to casting." With reference to casting he states: "Contraction and piping decrease with increasing silicon content; at about 11 per cent Si the alloys scarcely pipe at all and above this amount they begin to swell upon solidification."

A general review of the literature on silicon alloys is given by Escard in a book entitled "Aluminum in Industry," published by H. Dunod and E. Pinat, Paris, 1918.

Various Appearances of Silicon

A review of the literature on aluminum-silicon alloys reveals certain discrepancies. Fraenkel and, independently, Roberts report that the eutectic alloy contains about 90 per cent Al. Both these investigators prepared their alloys by the direct addition of elemental silicon to commercial aluminum. Vigoroux and Arrivaut, on the other hand, show by micrograph (Fig. 1) and also mention in the text of their article that in an aluminum-silicon alloy containing 14.82 per cent Si, dendrites of aluminum freeze out first—that is, the aluminum is in excess of the eutectic composition. The silicon in this sample is very finely dispersed. According to Fraenkel and Roberts, such an alloy should contain excess silicon and all the aluminum should be in the eutectic. It will also be recalled that Frilley specifically states that aluminum-silicon alloys prepared by electrolysis of a bath containing both alumina and silica have different characteristics, both physically and chemically, from alloys prepared by the melting together of aluminum and silicon.

These observations have since been confirmed experimentally. When an aluminum-silicon alloy is prepared by direct electrolytic reduction, poured into a containing vessel and permitted to solidify, the silicon is found in the resulting alloy in a finely dispersed state. On the



FIGS. 2 TO 5—ALUMINUM-SILICON ALLOYS WITH 10 PER CENT SILICON

Fig. 2—Normal aluminum-silicon eutectic. 90 per cent aluminum and 10 per cent silicon. × 200.

Fig. 3—Normal aluminum-silicon alloy containing 10 per cent silicon and 1 per cent iron. × 200.

Fig. 4—Aluminum-silicon alloy containing 10 per cent silicon and 1 per cent iron made by direct electrolytic reduction. × 40.

Fig. 5—Electrolytically prepared aluminum-silicon alloy containing less iron than the one shown in Fig. 4. × 40.

other hand, in the alloys containing less than 10 to 11 per cent Si prepared by melting together the two elements, the silicon is present in the form of relatively large thin plates. In alloys containing more silicon, the eutectic portion of the silicon is present in the form of relatively large thin plates, whereas the excess silicon appears as more or less equiaxed polyhedral particles, as shown in Figs. 7 and 10.

Fig. 2 shows the normal structure of a sand-cast alloy

FIG. 6—SAME AS FIG. 4, BUT × 250

containing 10 per cent Si, made by the direct melting together of aluminum and silicon. Fig. 3 shows the structure of a sand-cast aluminum alloy containing 10 per cent Si and about 1 per cent Fe, prepared by direct melting. Iron forms a silicide reported to be $FeSi_2$; some of the needles or plates in Fig. 3 are silicide and some are silicon. Figs. 4 and 6 show the structure of an alloy of approximately the same chemical composition—namely, Si 10 per cent, Fe about 1 per cent—prepared by direct electrolytic reduction of silica and alumina. The iron silicide plates are about the same size as in Fig. 3, but the silicon is present in very small particles and the aluminum in dendrites. Fig. 5 shows another electrolytically prepared alloy containing less iron, which has better properties.

Influence of Method of Manufacture

Not only does this process of manufacture greatly affect the condition of the silicon as regards dispersion, but strangely enough it actually changes the composition of the eutectic alloy from 10 to 11 per cent Si in the alloys prepared by direct fusion to 15 per cent Si in the alloys prepared by electrolytic reduction. The amount of excess material of course changes as the eutectic composition changes. The freezing point of the eutectic may be lowered from 576 deg. in the alloys prepared by fusion to about 564 deg. C. in the alloys prepared by direct electrolytic reduction.

Micrographs of the 14.82 and 4.81 per cent Si samples of Vigoroux and Arrivaut show a structure identical with the typical structure produced by direct electrolytic reduction. As previously noted, their alloys were prepared in small porcelain crucibles by melting together commercially pure aluminum and an aluminum-silicon alloy containing about 50 per cent Si, "the immediate product of the reduction of potassium fluosilicate by aluminum." It is evident that their method of preparation produced an alloy having the same structure and therefore the same properties as the alloys obtained electrolytically, a structure evidently caused by the action of the potassium fluosilicate at the elevated temperatures. The correctness of this latter statement is substantiated by the recent work of Pacz, who produced the same structure by the use of compounds of alkali metals with fluorine.

If we refer to the aluminum-silicon alloys made by melting together the two elements as the "normal" alloys and those prepared by the simultaneous electrolytic reduction of alumina and silica as the "modified" alloys, then the alloys prepared by Minet and Vigoroux in 1856 were "modified." A modified alloy may be melted and if it is quickly resolidified it still has the modified structure and characteristics. If permitted to remain in the molten state it gradually passes over to the "normal" condition.

The earlier aluminum-silicon alloys were prepared in different ways, so that some were "normal" and others "modified." Vigoroux and Arrivaut prepared modified alloys; at least the 4.81 and 14.82 per cent Si samples were "modified," whereas Fraenkel and Roberts prepared "normal" alloys. To the best of my knowledge Frilley was the first investigator to differentiate between the two varieties of aluminum-silicon alloy.

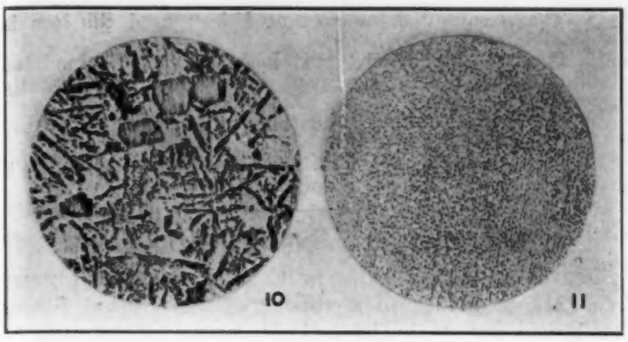
Investigations made by the staff of the Aluminum Co. of America accord nicely with those of Fraenkel and Roberts on the "normal" alloys and with Vigoroux and Arrivaut on the "modified" alloys. We find no chemical compound of aluminum and silicon. The modified

FIGS. 7 TO 9—NORMAL ALLOY MODIFIED BY PACZ METHOD

Fig. 7—Normal aluminum-silicon alloy containing 12.58 per cent silicon. Eutectic plus excess silicon. × 250.

Fig. 8—Same alloy shown in Fig. 7, modified by Pacz process. Eutectic plus excess aluminum. × 50.

Fig. 9—Same as Fig. 8, but × 250.



FIGS. 10 AND 11

"Silumin"; normal and modified structure respectively. × 175. (Metallbank).

alloys and normal alloys show the same type of crystalline silicon by X-ray crystal analysis.

Quite recently A. Pacz of Cleveland (U. S. Patent 1,387,900, Aug. 16, 1921) devised a method of "modifying" the "normal" aluminum-silicon alloys. His process consists briefly in the preparation of the aluminum-silicon alloy by the direct mixture of the two metals, and after the alloy is molten an alkali fluoride—such as NaF, KF, LiF or some other compound containing fluorine and an alkali—is placed on top of the molten alloy. He preferably employs NaF as a base and stirs the pulverized compounds into the molten metal with a carbon rod. After skimming, the alloy is poured and then possesses the properties similar to those obtained by the direct electrolytic reduction of aluminum and silicon. Fig. 7, for example, shows the structure of an alloy containing 12.58 per cent Si made by the direct melting together of aluminum and silicon and cast without any further treatment. Figs. 8 and 9 show another portion of the same alloy after modification in the manner described by Pacz. In the first case, it will be noted that the alloy contains excess silicon plus eutectic in which the eutectic silicon is present in the form of relatively large plates, whereas in Figs. 8 and 9 it will be noted that the alloy contains excess aluminum and the silicon is entirely present in the eutectic in a finely dispersed state.

"SILUMIN"

Apparently aluminum-silicon alloys treated by a similar process are called "Silumin" in Germany. Figs. 10 and 11 show the structure as published by the Metallbank and Metallurgische Ges.; Fig. 10 is the alloy poured without any treatment and Fig. 11 the alloy poured after the treatment. It will be noted that there is a considerable quantity of excess silicon in the former figure, whereas the latter shows eutectic composition.

Figs. 12 and 13 show the structure of modified aluminum-silicon alloys containing 11.9 per cent Si prepared by Mr. Pacz. The silicon is finely dispersed and there is excess aluminum in the sample. A normal alloy containing 11.9 per cent Si shows excess of silicon.

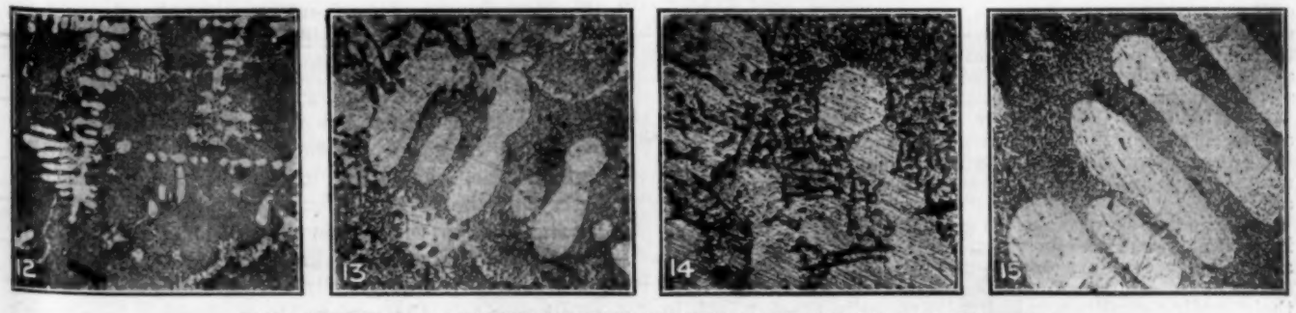
The improvement in physical properties by modification is slight in 5 per cent alloys, but quite marked in aluminum alloys containing between 8 and 15 per cent silicon. Thus the improvement as compared to the normal alloys is more marked the higher the silicon content. With a silicon content of 13 per cent the tensile strength of a sand-cast normal alloy is about 20,000 lb. per sq.in. and the elongation about 2 per cent in 2 in. However, this alloy, modified by the Pacz method and cast in sand, may have a tensile strength of 27,000 lb. per sq.in. with an elongation of 6 or 7 per cent in 2 in. The degree of improvement depends, among other things, on the quantity of flux used. Fig. 14 shows the effect of a small quantity of flux on an aluminum alloy containing 10 per cent Si. It will be noted that the silicon is somewhat refined as compared to Fig. 2. Fig. 15 shows the effect of a greater quantity of flux on the same alloy. Remelting of an alloy modified by the Pacz process, in such a manner as to permit the metal to remain in the molten state for any considerable time causes a reversion to the "normal" condition. The ordinary melting of large batches (10 lb. or more) causes the modified alloy to revert to the normal or nearly normal state.

PHYSICAL PROPERTIES

The aluminum-silicon alloys are in general resistant to corrosion if the iron content is not excessive. They can be machined, but not as readily as the aluminum alloys customarily used for castings. The density of aluminum-silicon alloys is about 2.65, as compared with about 2.85 for the aluminum-copper alloys.

One of the chief advantages of aluminum-silicon alloys is their good casting properties—a sound "leak-proof" piece may be obtained either in the normal or modified condition.

It will be noted in Fig. 6 that the alloys prepared by direct electrolytic reduction do not show any considerable refinement of the iron silicide plates. This is also true of alloys treated with the Pacz flux. Inasmuch as any considerable quantity of these iron silicide plates will weaken and embrittle the metal, it is essential to keep the iron content low either in the normal or modified alloys. In general it may be said that the lower the silicon content the greater will be the amount of iron permissible in the alloy. With 5 per cent Si, for example, a tensile strength of 18,000 lb. per sq.in. and elongation of 4 to 6 per cent in 2 in. is obtained in the normal state, even with an iron content as high as 0.75



FIGS. 12 TO 15—ALUMINUM-SILICON ALLOYS, MODIFIED BY PACZ METHOD

Fig. 12—Modified aluminum-silicon alloy containing 11.9 per cent silicon. × 40.
Fig. 13—Same as Fig. 12, but × 200.
Fig. 14—Aluminum-silicon alloy containing 10 per cent silicon, partly modified. × 200.
Fig. 15—Same alloy as Fig. 14. Completely modified. × 200.

per cent. This alloy is also machinable, but it does not machine as well as the ordinary aluminum alloys.

Although the tensile strength and elongation of the modified aluminum-silicon alloys are very satisfactory, the yield point is quite low. At a stress of 12,000 lb. per sq.in. the extension is about 2½ times that of No. 12 alloy, which contains about 92 per cent Al and 8 per cent Cu (Metallbank).

Only small quantities of aluminum-silicon alloys are used commercially at present. It seems, however, that they will be found suitable for thin-walled castings and watertight parts. In some places the alloys should be used because of their resistance to corrosion. The modified and normal alloys have about the same advantages with the exception of tensile strength. Many uses will not require high tensile strength, so it is probably safe to predict that the alloys will be used in both the normal and modified conditions according to requirements. When the sand-cast alloys are used in the normal state the silicon content should, in general, be lower than in the modified alloys. In the latter the silicon may be from approximately 8 to 15 per cent and in the former from about 4 to 10 per cent.

Summary

1. Aluminum-silicon alloys were first prepared as early as 1856 by Deville.
2. As early as 1856 Wöhler had prepared aluminum-silicon alloys by fusing together metallic aluminum and an excess of double fluoride of potassium and silicon in an ordinary crucible.
3. As early as 1858 an aluminum-silicon alloy containing approximately 10 per cent Si had been mechanically worked.
4. An extensive study of aluminum-silicon alloys was made in the early '90s by Minet and others, who describe physical properties of a number of electrolytically prepared alloys both in the cast and forged conditions.
5. In 1901 Vigoroux and Arrivaut described the structure of aluminum-silicon alloys containing 4.81, 14.82, 25.35 and 45.5 per cent Si. The 14.82 per cent alloy shows excess aluminum dendrites plus eutectic. The eutectic structure shows a very fine dispersion of the silicon.
6. In 1908 Fraenkel gave the first constitutional diagram of aluminum and silicon, showing that normally the composition of the eutectic alloy is 90 per cent Al and 10 per cent Si and its freezing point is 576 deg. C.
7. In 1911 Frilley discovered that aluminum-silicon alloy prepared by direct electrolytic reduction "has very different properties from those of the metal obtained by melting together the two substances."
8. In the "modified" alloys produced electrolytically the silicon is much more finely dispersed, the eutectic contains a greater quantity of silicon, and the freezing point of the eutectic is lower than in the "normal" alloys prepared by the melting together of aluminum and silicon. The tensile strength becomes greater and the elongation greater as the dispersion of the silicon becomes finer.
9. In 1920 A. Pacz of Cleveland worked out a process of "modifying" the "normal" aluminum-silicon alloys.
10. The modified aluminum-silicon alloys prepared by Frilley's electrolytic reduction method, by Vigoroux and Arrivaut's potassium ferrosilicate method and by the Pacz sodium fluoride method revert to the normal types if permitted to stand in the molten state for any considerable time. Remelting such alloys in large batches and recasting are sufficient to cause the alloys to revert to the normal structure and normal properties.
11. Aluminum-silicon alloys in general are quite resistant to corrosion, if the iron content is low.
12. Aluminum-silicon alloys are machinable, but they do not machine as well as the standard aluminum-copper alloys.
13. The use of processes to modify or disperse the silicon is advantageous chiefly when quantities of silicon above about 8 per cent are used.
14. The chief advantage of aluminum-silicon alloys is in their casting qualities, which advantage is present both in the normal and modified alloys.
15. Iron makes the aluminum-silicon alloys more corrodible and in general weakens and embrittles them.
16. The greater the amount of silicon used the less is permissible iron.
17. It is safe to predict that both normal and modified aluminum-silicon alloy castings will become commercially important.
18. In the modified alloy castings silicon should be from 8 to 15 per cent.
19. In the normal sand castings silicon should be from 4 to 10 per cent according to requirements.

Carbon Black From Natural Gas in 1921

The carbon-black industry showed marked progress in 1921, according to a report of the United States Geological Survey. The estimated total output was 14 per cent greater than in 1920. The following table, which shows the output by states, is based on reports from nearly all the operators:

ESTIMATED PRODUCTION OF CARBON BLACK FROM NATURAL GAS IN THE UNITED STATES IN 1921, BY STATES

State	No. of Plants	Carbon Black Produced: Lb.	Value	Average Price Per Lb. (Cents)	Average Yield of Carbon Black Per 1,000 Cu.Ft. Lb.	Gas Used (Thousands of Cu.Ft.)
Kentucky	2	2,697,075	$215,822	8.0	1.8	1,518,763
Wyoming	2	419,400	37,521	8.9	0.5	869,000
Oklahoma, Pennsylvania, Montana	3	573,225	38,707	6.8	0.9	629,492
West Virginia	21	23,909,000	2,088,000	8.7	1.7	14,312,800
Louisiana	13	31,034,000	2,967,000	9.6	1.0	32,101,800
Total for 1921	41	58,632,700	5,347,050	9.1	1.2	49,431,855
Total for 1920	35	51,321,892	4,032,286	7.9	1.3	40,598,978
Total for 1919	36	52,056,941	3,816,040	7.3	1.0	49,896,235

The average yield of carbon black per thousand cubic feet of gas consumed was slightly lower in 1921 than in 1920, although the efficiency of some of the plants had been materially increased. The yield in 1921 ranged from 0.2 to 3.5 lb., and the maximum was 1.5 lb. higher than the maximum in 1920.

The manufacture of printer's ink consumes approximately from 20 to 25 per cent of the total output of carbon black. About 30 to 35 per cent is used in the rubber industry, where it serves chiefly as a reinforcing agent. A considerable quantity of carbon black is exported to be used for similar purposes abroad but more especially for printer's ink.

The carbon-black industry is an economic factor in the development of new gas fields. This industry can easily be successful in new areas that are sparsely populated and at long distances from markets and that present other unfavorable conditions. Its one requirement is a sufficient supply of natural gas, and in fact an isolated area where there is a sufficient supply of natural gas is an ideal location for carbon-black plants, because there is no domestic demand for the gas. The best illustration of the carbon-black industry as an aid in the development of new and remote natural-gas fields is furnished by the Monroe field in Louisiana. About 5 years ago only a few wells had been drilled in that field in an unsuccessful search for oil. Owing to its remoteness from large cities and communities there is little demand for the gas for domestic use, and this field has therefore been a fertile one for the carbon-black industry, as shown by the quantity produced there.

In the interest of conservation the Department of Conservation of Louisiana has formulated rules requiring the extraction of gasoline from the gas before the gas is burned in the carbon-black plants. As a result most of the carbon-black plants are operated in conjunction with the gasoline plants.

T.A.P.P.I. BANQUET AT THE ASTOR, NEW YORK, APRIL 11, 1922

Seventh Annual Meeting of T.A.P.P.I. Held in New York

Technical Association of the Pulp and Paper Industry Holds Enthusiastic Convention at the Waldorf-Astoria, Pervaded by a Spirit of Optimism for the Immediate Future of the Business, Which Is Emerging From the Period of Depression

FROM the first day of the convention week, April 10, when the technical personnel of the American pulp and paper industry began congregating at the Waldorf-Astoria in New York, a general feeling of optimism was evident.

"The trade is optimistic today, where a year ago it was just the reverse," said W. J. Raybold, president of the American Pulp and Paper Association. "The paper and pulp men have been taking heavy losses, but business is improving and the outlook is more hopeful than in many months."

The convention of the Technical Association was held in connection with the forty-fifth annual meeting of the American Pulp and Paper Association together with other affiliated associations. Sessions of all the sections were held in the Waldorf-Astoria through the week up to Thursday evening.

T.A.P.P.I. re-elected all the present officers—namely: G. E. Williamson, Strathmore Paper Co., president; F. C. Clark, Pejepscot Paper Co., vice-president, and W. G. MacNaughton, secretary.

The high spots in the convention proceedings were the interest displayed in the subject of vocational education and the practical consideration of the technical study of the drying of paper. Prof. David Snedden of Columbia University and J. C. Wright, director of the Federal Board of Education, were the principal speakers on the subject of vocational education, a subject in which the association has been actively interested for some time. In connection with the publication of the third volume of the series of textbooks on "The Manufacture of Pulp and Paper" by the society, the discussion was of especially timely interest.

The problem of the drying of paper is being taken up by the association as a systematic engineering investigation. Besides the paper read by M. B. Littlefield, which is briefly discussed below, F. C. Clark, of the Pejepscot Paper Co., contributed to the symposium on this subject, which was one of the most important which came before the convention. Representatives of a number of paper mills entered the discussion and will continue the study of the problems along the basic lines prescribed.

Sectional Meeting on Soda Pulp and Sulphate Pulp

"Some Factors Influencing the Yield and Strength of Pulp Cooked by the Soda Process" were discussed by Martin L. Griffin. The parallel between the process in cotton textile finishing and reducing wood to finished pulp by the soda process was pointed out. The low yield of the soda process compared with the sulphite and sulphate processes is attributed to the fact that the latter are deoxidizing and therefore act to preserve the strength and increase the yield. Experiments have shown that the addition of small quantities of sulphur increases the yield by its deoxidizing action. A posi-

tive pump to circulate the liquor in either direction and to prevent the direct exposure of part of the chips and pulp to high pressure steam was also recommended as a step to improve yields.

"Recovery and Its Control," by George K. Spence, took up methods of determining the percentage of the original soda used that is recovered and returned to the system. Mr. Spence described the system instituted at Johnsonburg by which the actual recovery for any one period can be calculated and losses located.

Sectional Meeting on Heat, Light and Power

"Modern Lighting for Paper and Pulp Mills," by J. H. Kurlander of the Edison Lamp Works, was illustrated by stereopticon views contrasting the average unsatisfactory lighting practice with up-to-date installations where the proper lamps and reflectors are intelligently used. Mr. Kurlander described a number of typical installations in machine rooms, beater and finishing rooms, and presented curves showing the methods used for correctly spacing and hanging lights for proper illumination.

"The Power Plant of the Paper Industry," by A. G. Darling and H. W. Rogers, pointed out the economies that may be effected by intelligent co-ordination of steam and electric power. The mechanical power requirements of the plant and the process steam requirements were summarized, and upon this basis suggestions were made as to the most efficient machinery for each purpose. Economies that may be effected by the installation of modern hydraulic equipment, electric boilers where hydro-electric power is available and automatic hydro-electric generators were outlined.

Additional emphasis was laid on the use of the last-mentioned apparatus by Horace Drever and Frank Hodson of the Electric Furnace Construction Co. in a paper entitled "The Electric Steam Generator." It is claimed that the use of electricity will save the cost of installation in a little over a year. The generator provides a means of utilizing idle power and thus improving the load factor and occupies small ground space, being simple, reliable and easily controlled.

Sectional Meeting on Mechanical Pulp

"The Efficient Production of Mechanical Pulp," by Adolph F. Meyer of Minneapolis, Minn., discussed the widely different methods of producing mechanical pulp for newsprint and the power consumption in different mills. Mr. Meyer presented curves emphasizing the importance of the proper grinder speed as influencing power consumption and described various installations of governors for this speed control. The shortcomings of the centrifugal pump as a pulp-grinder governor were emphasized and performance records in which the Meyer governor was used were presented in contrast.

"Relative Efficiency of the Automatic Magazine Grinder as Compared With the Pocket Type Grinder" was the title of J. J. Case's paper, which compared the two types of grinders with regard to labor costs, power and maintenance charges. The economical advantages of the automatic magazine type were clearly demonstrated.

The Drying of Paper

"The Drying of Paper," by M. B. Littlefield, took up the problems of drying under the subjects of the properties of paper under heat, proper drying conditions, heat supply and removal of water vapor. Studies of the effects of variations in thickness, furnish, entering and final moisture content and critical moisture content have been made on various grades. The amount of drying accomplished by suction, presses and driers has been determined. Careful studies have also been made of the quantity of heat supplied to the driers and the factors which influence its efficient utilization. Under the topic of the removal of water vapor, the most efficient methods of air circulation were discussed. Drying curves were given to show the rate of removal of water under certain drying conditions, and the effect of steam pressure on rate of drying and consequently on production. Drying ovens, speedometers, pressure gages and accurate records were recommended for efficient drying.

Cotton Linter Pulp

"Stamso-Cotton Linter Pulp," by Stewart E. Seaman of the Stamsocott Co., described the manufacture of this new product, the various grades and qualities and the application of the product in the high-grade paper trade. This pulp may be used in place of rags with a very material saving.

Report of the Sulphite Pulp Committee

The sulphite pulp committee called attention in its report to the need for the development of a more complete knowledge of the constitution of lignin and announced the publication of a translation of the fundamental research of Peter Klason on the constitution of lignin and of Rudolf Sieber's work on the analysis of raw sulphite acid. The report also suggested work on the development of a rapid method for the determination of residual lignin in unbleached sulphite pulp and for the direct determination of combined SO_2 in sulphite acid.

The committee presented its recommendations for specifications for limestone and lime in the manufacture of sulphite pulp.

G. P. Gensberg presented a paper on the "Analysis of Reclaimed Cooking Acid for Sulphite Mills."

The Chemistry of the Sulphite Process

"The Chemistry of the Sulphite Process," by R. N. Miller and W. H. Swanson of the Forest Products Laboratory, presented work of the laboratory in investigating the fundamentals of this process and showed their application in a series of experimental cooks. In this investigation, the total SO_2 content was determined at intervals through the cooks by blowing the cooks prematurely and examining. The apparatus and methods of analysis used were described. It was found that the marked change in chemical composition of the liquor ceased at about the same time that the pulp of superior quality was produced—namely, about the eleventh hour. The rate of removal of lignin was also studied. The importance of the content of free sulphurous acid at the end of the cook was pointed out.

Banquet

Tuesday evening was set aside for the annual feast at the Astor. A large attendance enjoyed an excellent program of speakers, the principal speech being given by Otis W. Caldwell, director of the Lincoln School, New York, on "The Scientific Mind." Judge Charles F. Moore acted as toastmaster.

Technical News of the Week

Current Events in the Chemical, Metallurgical and Allied Industrial Fields—Legislative Developments—Activities of Government Bureaus, Technical Societies and Trade Associations

Discussion of Disposal of Muscle Shoals Features Joint Meeting of Engineering Societies

Dream cities built up around limitless power resources, fertilizer cheap as dirt and the adaptation of the government nitrate plants for the production of peace-time products were reduced to absurdities by an array of distinguished speakers in a symposium on the Muscle Shoals problem before a joint meeting of the four founder societies in the Engineering Societies Building, New York, on April 14. The discussion was divided into its two logical phases—namely, the project as a power producer and as a nitrate producer. Brigadier-General Harry Taylor, Assistant Chief of Engineers, U. S. A., took up the first topic, and W. S. Landis, of the American Cyanamid Co., discussed the commercial aspect of the second phase, while Major-General C. C. Williams, Chief of Ordnance, U. S. A., spoke on the munitions aspect.

Theodore Nagel, consulting engineer, gave a concise description of the cyanamide process as used in Plant No. 2 which served to make clearer the actual operation of the plant as shown in several reels of motion pictures. The pictures showed the construction and operation of Plant No. 2 and views of the steam power plant on the Tennessee River.

General Taylor presented a history of attempts that were made since 1828 to develop the Tennessee River at Muscle Shoals for navigation and as a power site and gave numerous statistics on construction features of the Wilson dam, with stereopticon views showing details.

W. S. Landis told of the organization of the Air Nitrates Corporation, a subsidiary of the American Cyanamid Co., for the erection of Plant No. 2, one of the largest war operations ever undertaken. The calcium carbide capacity of the plant greatly exceeds the demand of the entire country. The cyanamide produced there is not suitable for fertilizer, said Mr. Landis, and should not be confused with the fertilizer material known under the trade name of "Cyanamid."

The country's maximum peace requirements of ammonium nitrate is 20,000 tons per year. Plant No. 2 has a capacity of 110,000 tons annually. The ammonium nitrate used in industrial explosives is made from the waste acid of the explosive industry and it is doubtful if Muscle Shoals nitrate could be produced as cheaply. The production of "Cyanamid" fertilizer or mixed salts has been suggested. Such plans would mean that the oxidation and absorption plants would be useless and would require the erection of sulphuric acid plants and large bagging and shipping facilities. Only 150,000 tons of ammonium sulphate per year is used in fertilizer and the increase in the production from byproduct plants would seem to indicate that competition in this field would be a losing proposition. Altogether the prospects for the commercial utilization of the plant seem discouraging to Mr. Landis.

Major-General Williams discussed the necessity of munitions for military preparedness in general. The Ordnance Department is not concerned over the process used for the fixation of nitrogen, he said, but it does hope for the development of a commercially practical process as a preparedness measure. He described the serious shortage of nitrate that existed in the Civil War and pointed out that in the World War America depended upon Chile for 75 per cent of the nitrate used and that these fields are being exhausted at the rate of 2,500,000 tons per year. Plant No. 1 at Muscle Shoals, which cost $13,000,000, was stamped as a "failure," but Plant No. 2 operated long enough to prove that it was capable of its full rated production. This plant cost about $70,000,000, but it would have paid for itself in 3 years, had the war continued.

A banker's view of the situation was presented by Francis E. Frothingham, of Coffin & Burr, bankers. This firm has distributed $20,000,000 of Alabama Power Co. bonds and Mr. Frothingham therefore felt qualified to compare the offer of that company with Henry Ford's. While acknowledging Mr. Ford's ability as a manufacturer, the speaker expressed the belief that the same offer from any other source would have been instantly repudiated. He emphasized the necessity for observing the provisions of the federal water-power act and declared that all bids should be submitted on this specification. He characterized as unfair Mr. Ford's failure to denounce the glittering real estate promotion schemes built around the "75-mile city" and the absurd propaganda to the effect that he saved Muscle Shoals from the junk-heap and from exploitation by foreign capital. He compared the details of the two offers, pointing out that the power company would accept the law, spend its own money for the completion of the dam and be bound to serve the public without discrimination and for only a fair return.

Mr. Frothingham emphasized the desirability of utilizing the Muscle Shoals power for public utility so that it might fit in its logical place in superpower development. The Alabama Power Co., with its experience and good record as a public utility as well as by its prior interest in the development, should receive first consideration.

E. A. Yates, of the Wood, Hulse & Yates Co., engineer, went into the details of the power situation in the South. He argued for the distribution of the Muscle Shoals power as against concentrating the consumption there. Mr. Yates estimates the available power at Muscle Shoals at 2,100,000 kw.-hr. annually at 80 per cent efficiency and 100 per cent load factor. The absolute prime power, based on the average river flow for 22 years, is only 400,000,000 kw.-hr. yearly. As far as power is concerned, he concluded, the greatest benefit will be derived by distribution. The greater the system to which the dam is connected the greater will be the utilization of secondary power.

Little Interest in Dye Inquiry—End of Testimony in Sight

Completely overshadowed by the completion of the tariff schedule, the dye investigation dragged half-heartedly through another week without new developments. It is expected that hearings will be concluded within the next few days.

C. J. Thatcher, vice-president of the Thatcher Process Co. of Syracuse, N. Y., advanced the conclusion that industry can be developed to meet the needs of the country only by the selective embargo system. This conclusion is unescapable after a study of the tariff history and statistics of the United States for the past 40 years, he said.

The "concrete result of previous attempts to build up an American industry by ad valorem tariff protection was to give the German dye monopoly control of the American market," the witness declared.

Ward Thoron, treasurer of the Merrimac Manufacturing Co., of Lowell, Mass., and Huntsville, Ala., attacked the present system of licensing imports and asserted that it caused annoying and intolerable delays to the dye users. Mr. Thoron argued that a tariff would give the American dye and organic industry all the protection it needs; the selective embargo system would place dye users at a disadvantage in competing with foreign manufacturers on certain textile products, he declared, because of the delay entailed in obtaining necessary foreign dyes.

Connecticut Valley Engineering Societies Hold Annual Joint Meeting

Over three hundred members of the chemical engineering societies represented in the Connecticut Valley met at Hotel Bond in Hartford April 11 for the annual joint meeting.

The principal speaker was Dexter S. Kimball of the Engineering School of Cornell University and president of the American Society of Mechanical Engineers. The subject of his address was "Engineering Civilization." Dr. Kimball said that the only distinction between our civilization and the civilizations that preceded it consisted in a greatly increased production made possible by engineering methods. In no other respects do we differ from the nations of antiquity. Dr. Kimball believes that the science of engineering will provide a solution for the problems which have overwhelmed the nations in the past.

The second speaker on the program was Hiram Percy Maxim, who gave a very interesting talk on thee "Development of the Wireless Telephone." He sketched briefly the various contributions made by the men who have been the leading figures in wireless communication. Prof. Bristol gave an exhibit of his sound reproducer which has just been developed at his laboratories. Numerous tests showed the exact reproduction of both voice and musical instruments.

Chicago Chemists Club Elects Officers

Annual meeting and election of officers of the Chicago Chemists Club occurred at the quarters, 315 Plymouth Court, on the evening of April 7. The retiring president, Otto Eisenschiml, gave an exceptionally well received talk on the things for which the club stands. His kindly and genial good-fellowship is ever a source of warmth to the members, and the chief regret was that he could not remain the permanent president. The retiring secretary, Paul Van Clief, made an excellent speech. His faithful service over two régimes brought a vote of thanks from the membership.

The principal feature of the evening was an illustrated talk on crystalline forms of water by ex-President William Hoskins. Snow flakes are his hobbies and he wove a fairy tale in the telling, to the delight of the old and young alike.

Officers elected for the coming year were: Chester H. Jones, president; G. A. Menge, first vice-president; Otto Stanger, second vice-president; A. E. Schaar, secretary; Oscar H. Wurster, treasurer; William Hoskins and L. M. Tolman, trustees.

Government Kelp Plant to Be Enlarged and Operated as Private Enterprise

The kelp potash plant of the Bureau of Soils, U. S. Department of Agriculture, at Summerland, Cal., was sold and transferred on April 1 to Rodney Benson of Santa Barbara. This plant was constructed in 1917 and operated for 4 years as an experimental and demonstrational plant with a view to the development of processes for extracting potash and byproducts from the giant kelps of the Pacific. It was closed through Congressional action in 1921. The plant will be enlarged and put back into operation at once for the manufacture of "Kelpchar," a decolorizing carbon of very high activity, potash salts, and iodine. Dr. J. W. Turrentine, who was in charge of the plant throughout the period of the experimentation, after turning over to the government's successors the manufacturing data established there, will return to Washington, D. C.

Historic Powder Plant to Be Scrapped

E. I. du Pont de Nemours & Co., Wilmington, Del., have permanently closed their historic powder mills at Brandywine, near Wilmington, and the plant will be dismantled. The mills were founded 120 years ago, in 1802, by Eleuthere I. du Pont, and have been used continuously for the manufacture of powder and explosives up to a recent date. The plant site has been transferred to a realty company and the property will be disposed of to private interests, representing heirs of the original owners. The Brandywine mill was the first of its kind in this country and furnished munitions for the War of 1812 and the Civil War.

Exhibit of Industrial and Technical Photography to Be Included in Chemical Exposition

At a meeting held in the Waldorf-Astoria, New York, April 10, plans were discussed for the organization of an exhibit of commercial and technical photography. John H. Graff, of the Brown Co., acted as temporary chairman and presented a summary of the circumstances which seem to warrant an exhibition of this nature.

"During the last few years," said Mr. Graff, "photography has more and more developed to be an important factor in industry, commerce and science, and a number of large concerns have established permanent photographic departments of their own, as an aid to better efficiency in administration, engineering, research, buying, selling, advertising, education, co-operation and for many special purposes peculiar to the individual needs of the concerns."

Industrial photography can be divided roughly into three classes—work done with the ordinary camera, photomicrographic work and work requiring specially constructed equipment. The first class includes photographic records of accidents and control boards, photographs demonstrating evidence of waste and salvage, safety ideas and construction reports. The second class includes metallography, studies of concrete, powder, gelatin, bacteria, tanning, paint making and pulp and paper. In the special equipment class may be mentioned the "slow-motion" motion picture studies of physical tests and movements, aërial photography for topographic work and commercial photostat work.

Besides the valuable knowledge gained by such a conference and exhibition in regard to application, technique, equipment and material, it would demonstrate if it would be beneficial to form a permanent association for the development of industrial and technical photography and the necessary qualifications for the men selected to do this work. Such a convention would not only be of value to those who have already entered this field, or those who by an exhibition of this kind would be made familiar with the practicability of adopting it for their own use, but also to the manufacturers of photographic equipment and material and optical and other scientific instruments related to the same.

Among those attending the meeting were representatives of the U. S. Testing Co., Cooper-Hewitt Co., Ansco Co., Eastman Co., U. S. Rubber Co., Sharp & Hamilton, U. S. Bureau of Standards and Bausch & Lomb. It was agreed that the idea behind the movement is commendable and it was decided to arrange to hold the exhibit in connection with the Chemical Exposition in New York next September. Charles Roth, manager of the National Exposition of Chemical Industries, was elected chairman of a committee to consider further means of securing co-operation of the industries.

A second meeting will be held at the Chemists' Club, New York, on May 10, at which time it is hoped that those industries interested in the undertaking will have accredited representatives present.

South Urges Acceptance of Ford Shoals Offer

In consideration of the various lease offers for the Muscle Shoals, Ala., nitrate plants, the Senate Agricultural Committee last week heard Senator Underwood of Alabama and Colonel W. J. Borden of the Corps of Engineers, U. S. A. Senator Underwood urged acceptance of the Ford proposal. Colonel Borden said it would take 6 years to complete the nitrate project.

The Senate Committee on Appropriations in reporting the agricultural appropriation bill to the Senate adds $5,000 for investigations concerning the application of chemistry to agriculture.

Government to Sell Saltpeter

The War Department has called for bids for 40,000 tons of sodium nitrate. Opportunity will be offered for purchases of the material in quantities as small as 100 tons.

Government Exhibit on Dust Prevention Methods Planned at Fire Protection Convention

Numerous serious dust explosions and fires in the United States and Canada have led engineers in the Bureau of Chemistry of the United States Department of Agriculture to arrange an exhibit showing the need for preventive measures and the results of work that has been done. The exhibit, which will be shown first at the annual convention of the National Fire Protection Association at Atlantic City, May 8 to 12, will include three phases of dust explosion and fire prevention.

One panel of the booth will be devoted to the problem in its relation to industries where grain is milled or handled or where food products are made. It will include such plants as grain elevators, sugar refineries, flour mills, starch factories, and cocoa and spice mills. Another panel will show the danger of dust explosions in threshing machines and methods of prevention. This danger is always present where threshing is being done, but is more to be feared during dry weather and when there is much smut in the grain. The third danger emphasized in the exhibit is that of cotton gin fires. In this case there is technically no dust explosion, but the fine fibers of cotton, once a fire has started, burn with almost explosive violence. Such fires are often started by electric sparks generated by the rubbing of the cotton on metal pipes through which it is passing. Drawings and photographs will be displayed showing methods for reducing the danger.

Accompanying this three-panel booth will be a stereomotorgraph which will be used to show views of industrial plants, threshing machines and gins that have been wrecked or damaged by explosions or fires. The entire exhibit will be available for the use of associations or similar organizations interested in the prevention of dust explosions or fires. Application should be made to the United States Department of Agriculture.

Uncertainty as to Freight Rates Holds Up Raw Materials Orders

Decided differences of opinion exist among the members of the Interstate Commerce Commission in the matter of the proposed reduction in rates. Rumor has it that certain members believe that the railroads can afford no reductions at this time. Some believe rates can be reduced on basic commodities, while others believe there should be a general reduction on all commodities. With such a situation existing, it is obvious that a considerable delay may ensue. So far as coal is concerned, the psychological moment was passed when the decision did not come down on April 1. Had it not been for the strike, the delay in handing down this opinion would have had a very serious effect on the coal industry. The delay is discouraging buying of many commodities.

It may be that the Interstate Commerce Commission will await the action of the Railroad Labor Board, since the decision in regard to wages has such an important bearing on rates.

Very few contracts for coal are being made at this time, but in most of those that are being made the buyer is insisting on a clause which provides that he is to have the benefit of any reduction which may be made in freight rates.

New Government Bulletin on Edible Corn Oil

The result of its investigations into the preparation of an edible oil from crude corn oil has just been published by the United States Department of Agriculture as Department Bulletin 1010, a professional paper. A detailed account of the various processes in use is given, together with a discussion of experiments on the refining of corn oil under various modifications of the usual methods. A comparison is made of the economics of the methods proposed, and detailed plans of a commercial refining plant are presented. The bulletin is entitled "The Preparation of an Edible Oil From Crude Corn Oil." Copies may be obtained of the United States Department of Agriculture, Washington, D. C.

Proposed Working Clause in Patent Laws Modified as Result of Protests

Such sentiment against compulsory working of patents was evidenced at the initial hearing on that subject that Senator Stanley determined to redraft his bill. He expects to eliminate the 5- and 2-year limitations and change his bill so as to prescribe that patents shall be worked within a reasonable time, to be determined by the Commissioner of Patents.

Thomas E. Robertson, the Commissioner of Patents, declared his unalterable opposition to a working clause, because he believes it is imperative that the patentee have a monopoly. It is necessary, he said, to encourage invention and also is necessary to make the patent readily salable. A working clause, he declared, would discriminate greatly against the small inventor. He pointed out that the term of patents was changed from 14 to 17 years because it was shown that profits accrued mainly in the latter part of the term.

It was pointed out at the hearing that a large number of patents are taken out for protective purposes only during the research period. For that reason it was held that compulsory production would have the effect of giving a body blow to all research.

Frederick P. Fish, widely known patent attorney of Boston, and A. C. Oliphant, of the Federated American Engineering Societies, were among those who appeared against the bill.

The position of the Secretary of War and of the Ordnance Department was that the national defense is involved in the matter of patents, particularly when foreigners are not required to manufacture in this country.

Up-to-Date Powdered Coal Installation for T. C., I. & R.R. Co. Power Plant

The Tennessee Coal, Iron & Railroad Co., after thoroughly investigating the economies made possible by the use of pulverized coal as a fuel for steam generation, has decided to use it for its new boiler installation at Ensley, Ala. A contract has just been closed with the Fuller Engineering Co., Allentown, Pa., for the installation of the complete coal-driving, pulverizing and conveying systems to serve this plant and for burners and feeders for five 834-hp. Stirling boilers designed to operate at 200 per cent of rating.

The boilers will be situated approximately 600 ft. from the pulverizing plant and the fuel will be conveyed directly to the boiler bins by means of the Fuller-Kinyon transport system. The fuel will be diverted from the main line to the individual service bins through distributing valves and branch lines. The bins will be equipped with automatic bin recorders, which will keep the operator advised at all times as to the fuel conditions in the service bins.

New Sulphur Mining Plant for Freeport Co.

The Freeport Sulphur Co., New York and Freeport, Tex., awarded contract on March 24 to Dwight P. Robinson & Co. for the design and construction of a complete sulphur-mining plant at Hoskins Mound, Tex. Cloyd M. Chapman has been retained by the Freeport Sulphur Co. as consulting engineer.

The company now operates a large sulphur-mining plant at Freeport, Tex., consisting of four units which were built in the period from 1913 to 1918 by Westinghouse, Church, Kerr & Co., which has since been merged into Dwight P. Robinson & Co. This plant contains one of the largest installations of oil-burning boilers in the world.

Canadian Rolling Mill Destroyed by Fire

The east wing of the plant of the Vancouver Rolling Mills at Richmond, B. C., was destroyed by fire on the evening of March 31, with an estimated loss of between $50,000 and $60,000, about half of which is covered by insurance. Already plans are being made for the rebuilding of the plant.

Exposition of Power and Mechanical Engineering Planned for New York in December

Announcement has been made of the National Exposition of Power and Mechanical Engineering to be held at the Grand Central Palace, New York, from Dec. 7 to 13, 1922, by the managers of the exposition.

The exposition was decided upon by a group of engineers and manufacturers who had felt the need for such a means of having men get together, exchange ideas, see the latest development in equipment and lay problems before the manufacturer. It will be the foremost exposition of this kind and the first distinctly power exposition ever held. A number of progressive manufacturers have already engaged space for their exhibits.

The exposition will immediately follow the annual meeting of the American Society of Mechanical Engineers, and it is expected that the exhibits will supplement the programs and discussions at the professional meetings of the society. The professional divisions of the society will hold sessions relating to fuels, stokers, steam power plants, railroads, steam utilization in the paper industry, textile and gas power, and it is expected that the exhibits at the exposition will throw interesting light on the papers presented at these sessions of the A.S.M.E. meeting.

That the exposition will be comprehensive may be inferred from the plans, which are to include exhibits of every type of machine, apparatus, equipment, instrument, device and the various materials and supplies necessary in the operation of the complete power plant. The committee decided that its keynote should be "an exposition of apparatus employed in the generation, distribution and utilization of power."

The advisory committee for the exposition is under the chairmanship of I. E. Moultrop of the Edison Electric Illuminating Co. of Boston, and includes a number of prominent engineers.

Chemists of Thirteen Countries Meet to Promote International Good Will

An international meeting of chemists is to be held in Utrecht, Holland, June 21 and 23. Invitations have been sent to 100 chemists residing in thirteen different countries. These include men from the United States, Great Britain, France, Germany, Italy, Holland, Russia, Austria, Czechoslovakia, Denmark, Norway, Switzerland and Sweden. The purpose of the meeting is primarily scientific and social. A number of addresses will be presented by chemists in attendance at the meeting, but it is not the intention to undertake legislation with regard to chemical matters or other functions which are at present performed by the International Union of Pure and Applied Chemistry. The latter meeting is to be held at Lyons, France, June 28, and has not thus far included German or Austrian chemists.

Will Honor Pasteur on Centenary of Birth

The centenary of Pasteur's birth is to be celebrated at Strassburg next year and plans are under way for erecting a monument to his memory. Anyone desiring to make a contribution for the Pasteur centenary may do so through a committee which has been organized at Stanford University, consisting of Carl Alsberg, R. E. Swain and E. G. Martin. Prof. E. G. Martin, the chairman, may be addressed at the Department of Physiology, Stanford University, California.

Obituary

JOHN BALLOT, president of the Minerals Separation North American Corporation, died on Saturday, April 1.

KNOX TAYLOR, president of the Taylor-Wharton Iron & Steel Co., died on April 4 at his home at High Bridge, N. J. Mr. Taylor was the fifth generation of his family to manage the company, which was found in 1742. He was born at High Bridge, Oct. 19, 1873, son of the late William Johnston Taylor and of Mary Alward Taylor. He began his education at Chester, N. J., where for a time his father operated an iron blast furnace. Later he attended the Hill School at Pottstown, Pa., the Model School at Trenton, and was graduated from Princeton University with the degree of Bachelor of Science in 1895. In college he was a member of the track, athletic and football teams, and was selected as all-American guard. Mr. Taylor's love of outdoor life led him to engage in mining engineering work in the Rocky Mountains for 7 years after leaving college. He was a member of several clubs and associations, among them being the Engineers' Rocky Mountain and University clubs, American Society for Testing Materials, American Institute of Mining and Metallurgical Engineers, American Chemical Society, American Society of Mechanical Engineers, Society for Promotion of Engineering Education and Iron and Steel Institute (England).

Personal

A. E. BONN has resigned as general sales manager of the American Cyanamid Co. and as vice-president of the Air Nitrates Corporation and is now president of Bonn & Co., New York.

J. R. FRITZE has resigned as assistant metallurgist of the Keystone Steel & Wire Co., Peoria, Ill., to accept the position of chief metallurgist for the Avery Co. of the same city.

L. F. FROST, formerly with the Lisk Manufacturing Company, Ltd., Canandaigua, N. Y., the Enamel Products Co., Cleveland, and the Phillips-Clark Stone Co., Geneva, N. Y., has become chemist in charge of research and production with the Vitreous Enameling Co.

R. E. HALL has been appointed to take charge of the physical laboratory of the Pittsburgh station of the Bureau of Mines, where he will be engaged on solubility investigations. Mr. Hall was formerly with the Koppers Co., Pittsburgh, and with the Geophysical Laboratory, Washington.

J. K. HAYWOOD, chairman of the insecticide and fungicide board of the Bureau of Chemistry, completed 25 years' service with the bureau recently and was the recipient of a gold watch tendered him by his associates in the bureau and by former members of the Bureau of Chemistry staff.

G. A. HENDRIE, formerly assistant to the vice-president of the American Cyanamid Co., is now vice-president of Bonn & Co., New York.

ROBERT D. LANDRUM, chemical engineer for the Harshaw, Fuller & Goodwin Co., Cleveland, Ohio, has become vice-president in charge of development and sales for the Vitreous Enameling Co. and the Vitreous Steel Products Co., both of Cleveland.

M. LARUE has resigned his position as chief metallurgist of the Avery Co., Peoria, Ill., to accept a position with the Sherwin Williams Co. to do special sales promotion work in its St. Louis district.

JOHN MCCONNELL, formerly of the Interstate Iron & Steel Co., is now vice-president in charge of operation of the United Alloy Steel Corporation, Canton, Ohio.

J. W. REA, assistant engineer of the Eastern Clay Products Co., Pittsburgh, Pa., gave an interesting illustrated lecture on "The History and Manufacture of Vitrified Clay Pipe" before a meeting of the Allentown (Pa.) branch of the American Association of Engineers, on April 6.

HERBERT V. STEINER, New York, has been elected president of the Coplay Cement Manufacturing Co., Coplay, Pa., to succeed Ferdinand Loeb. GEORGE A. CHRIST, of Allentown, Pa., has been re-elected secretary and treasurer of the company.

BIRGER H. STROM is now research chemist in the Boston & Montana Department of the Anaconda Copper Mining Co., Great Falls, Mont.

DEAN E. WINCHESTER, for many years on geological work on coal, petroleum and oil shale for the U. S. Geological Survey and the Standard Oil Co. of N. J., has recently opened an office in Denver for geological practice, with special attention to petroleum and oil shale.

Market Conditions

IN CHEMICAL, METALLURGICAL AND ALLIED INDUSTRIES

A Survey of the Economic and Commercial Factors That Influence Trade in Chemicals and Related Commodities—Prevailing Prices and Market Letters From Principal Industrial Centers

Statistics on Paper Production

A summary of production, shipments and stocks in the paper mills of the United States during the month of February, 1922, has recently been compiled by the Federal Trade Commission. From these statistics it will be observed that the total production for all grades of paper was 501,817 net tons in February, 1922, as compared with 407,966 tons in the corresponding month of the preceding year and 463,841 tons as the average for the years 1917-21 inclusive. Shipments during February, 1922, exceeded 490,000 tons, and in the same month of 1921 amounted to 383,679 tons.

Likewise stocks on hands at the different paper mills at the beginning and end of the month were slightly larger than on corresponding dates in the previous year.

The principal increases in production were in the case of paperboard and boxboard, wrapping and bag paper, fine writing and book paper, and felt and building paper. The output of standard and special grades of newsprint showed marked decreases both in quantity and number of mills in operation. Only 65 were in active production in February, 1922, as compared with 88 in the preceding year.

Under the caption "Loss of Production" the report points out that in February, 1922, 934 paper machines were idle, as compared with 1,065 in February, 1921. The total number of idle hours in the later month was 128,842 and in February, 1921, over 202,000. Of the total number of machines not in operation during the second month of the current year, 580 were idle because of lack of orders, 124 for repairs and 230 because of lack of material, power or for other reasons.

Comparing the stocks on hand at the domestic mills on Feb. 28 with their average daily production, based upon the combined production for 1918-21, the figures show that:

Newsprint paper mill stocks equal 6 days' average output.

Book paper mill stock equals 13 days' average output.

Paperboard mill stocks equal 10 days' average output.

Wrapping paper mill stocks equal about 25 days' average output.

Fine paper mill stocks equal about 34 days' average. output.

Total paper mill stocks of all grades equal about 14 days' average output.

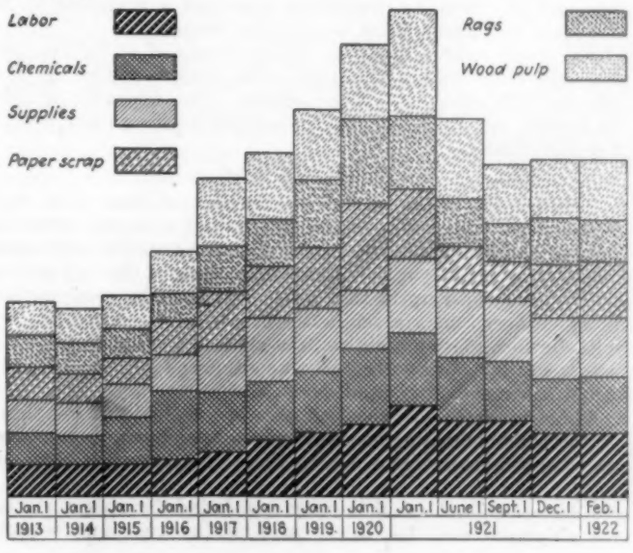
INDEX NUMBERS FOR FACTORS ENTERING INTO PAPER PRODUCTION COSTS

	1922	1921				1920	1919	1918	1917	1916	1915	1914	1913
	FEB. 1	DEC. 1	SEPT. 1	JUNE 1	JAN. 1	JAN. 1	JAN. 1	JAN. 1	JAN. 1	JAN. 1	JAN. 1	JAN. 1	JAN. 1
Wood Pulp	190	188	169	243	327	226	218	206	205	124	101	103	100
Rags	126	135	115	139	227	253	211	140	136	91	93	96	100
Paper Scrap	175	160	122	131	214	271	190	150	166	105	84	95	100
Supplies	183	185	190	210	225	181	178	178	138	118	105	102	100
Chemicals	173	170	181	196	220	223	191	179	188	216	143	90	100
All Mat'rials	171	171	157	202	271	230	207	180	175	122	103	99	100
Labor	204	204	234	234	276	225	197	168	130	111	100	100	100
Material & Labor	178	178	173	208	272	229	205	178	166	120	102	100	100

Paper Production Costs

An interesting study of the factors entering into the cost of producing paper is afforded by the accompanying table and chart prepared from data issued by the American Writing Paper Co., of Holyoke, Mass. The figures used are index numbers each based on a value of 100 for Jan. 1, 1913.

It will be noted that labor and wood pulp, which were the two most important elements in paper production costs in the peak month of January, 1921, still continue at comparatively high levels. Chemicals used in paper making were selling for 73 per cent above the 1913 figure on Feb. 1, 1922, having increased 3 per cent since Dec. 1 of the preceding year.



CHEMICAL & METALLURGICAL ENGINEERING'S WEIGHTED INDEX OF CHEMICAL PRICES

Base = 100 for the year July 1, 1913, to June 30, 1914

This week	158.81
Last week	158.36
April, 1917	207
April, 1918 (high)	286
April, 1920	261
April, 1921 (low)	140

This index number is based on the wholesale prices in the New York market for acetic acid, citric acid, hydrochloric acid, nitric acid, sulphuric acid, ethyl alcohol, methanol, anhydrous ammonia, ammonium sulphate, barium chloride, bleaching powder, borax, caustic potash, caustic soda, copper sulphate, formaldehyde, glycerine, potassium carbonate, saltcake, soda ash, crude sulphur, benzene, aniline oil, cottonseed oil and linseed oil.

The New York Market

NEW YORK, April 16, 1922.

The chemical market during the past week showed signs of irregularity in some directions, while in others a moderate volume of new orders gave an encouraging light to the general situation. The advancing tendency of the foreign exchange market was fully reflected in prices for shipment of chemicals from abroad. European inquiries for solid caustic soda continued to reach the market and prices are holding very firm. Soda ash is holding its own without any important feature. Prussiate of soda still remains in an easy state under an absence of any buying interest. Copper sulphate is moving moderately for export and domestic consumption. Glaubers salt and cyanide of soda dealers are finding extreme difficulty in selling goods even at material price concessions. Domestic producers of cyanide still quote the market at 26c. per lb. Chlorate of soda is finding a better outlet and the market seemed more active during the latter part of the week. Nitrate of soda is decidedly firmer and sulphate of ammonia is still lacking in the spot market, with shipment goods held at a premium for limited quantities. Higher prices for citric acid in Italy and the proposed tariff of 18c. per lb. have created a firmer market here, although the present domestic market is not very active. With the active season directly ahead, dealers are looking forward to a very strong condition in the citrate market.

GENERAL CHEMICALS

Acetic Anhydride—Producers report moderate trading on the basis of 38c. per lb., with a possibility of some shading on round lot business. The general quotation ranges from 38@40c. per lb., according to quantity.

Carbon Bisulphide—Sales were recorded at 6c. per lb. by first hands, f.o.b. works. Spot prices range from 6¼@7c. per lb., depending on the seller and quantity. The movement is rather quiet at present.

Cyanide of Soda—Domestic material is being sold in a regular way to consuming quarters, but importers are finding great difficulty in moving supplies. Imported material ranges from 22@24c. per lb., depending on the strength.

Caustic Soda—Inquiry for export remains quite active and several fair-sized orders were reported at $3.60@$3.65 per lb. f.a.s. Producers can offer only June-July shipment at $3.60. Leading jobbers offer small lots at $3.80@$3.90 per 100 lb. Producers offer contracts at 2½c. per lb., basis 60 per cent, f.o.b. works.

Calcium Chloride—Manufacturers report a steady market for the ground and solid grades. Carload lots of solid are offered at $24 per ton New York, and $21 per ton f.o.b. works. Granular is held at 1½c. per lb. New York and $27 per ton f.o.b. works. The demand from the roads and refrigerating industry is fully up to expectations.

Carbon Tetrachloride—Leading dealers offer car lots at 9½c. per lb. Smaller quantities command a premium up to 12c. per lb. The market is reported steady.

Sal Ammoniac—Imported, white is quoted at 7@7½c. per lb., depending on the quantity. The gray is higher at 7½c. per lb. with offerings rather scarce. The domestic is held at 7½@8c. per lb. The general outlook seems rather bright for this chemical.

VEGETABLE OILS

Linseed Oil—The market at the end of last week was very strong and prices named by leading domestic crushers ranged from 81@83c. per gal. Several crushers advanced quotations to 83c. per gal. and it was thought that all sellers would soon come up to this level, provided the seed market holds. There was a much better demand for nearby oil, and with foreign oil much higher, the general tone of the market was very firm. Imported oil was advanced to 76c. per gal., April shipment, duty paid, New York.

Chinawood Oil—Buyers' offers were a shade under those of the sellers during the week and actual business was not up to expectations, considering the active inquiry. Spot oil was offered at 13½c. per lb., in less than carload lots.

Coconut Oil—A good inquiry was noted for this material for shipment over the latter part of the year and several carlot orders have already been recorded for this shipment. Domestic Ceylon type oil for Aug.-Sept.-Oct. shipment went through at 7½c. per lb. The New York market was quoted at 7¾c. per lb., sellers' tanks, immediate shipment.

Corn Oil—The latest figures on actual sales were recorded around 9¾c. per lb., sellers' tanks, f.o.b. Chicago, indicating an easier market. The demand for refined oil was quiet and prices around 12½c. per lb. were heard.

Peanut Oil—Offerings of crude domestic oil were heard at 10c. per lb., tank cars, f.o.b. mills, Southeast. Oriental crude, in bond, was quoted at 8½@8¾c. per lb. Pacific coast. Local dealers of refined oil were asking 12½@12¾c. per lb., carlots. The demand was moderate.

Annual Reports

Celluloid Co. Shows Deficit.—The report of the Celluloid Co. for the year ended Dec. 31, 1921, shows a deficit of $1,146,239 after depreciation, inventory reduction, taxes and other charges. This is to be compared with a net income of $1,072,413 for 1920. The total income prior to deductions was $36,752, as against $2,055,532 for the previous year. Depreciation of $300,000, an inventory reduction of $428,352 and other charges amounting to $454,639 were deducted from the 1921 income.

American Smelting & Refining Co. Shows Smaller Income.—The net operating income from this company's smelting and refining plants before providing for bond interest, depreciation, obsolescence, ore depletion, etc., was $8,180,970.13, a decrease of $5,108,649.44 as compared to 1920. After making all deductions the net income from the year was $1,591,908.92 in comparison with $6,674,778.70 in 1920.

"The main factors in the year's poor showing," says the report, "was the extremely small production of copper, zinc and tin." The company's output of its principal products in 1920 and 1921 are compared with the pre-war year 1914 in the following table:

	1921	1920	1914
Gold (oz.)	1,780,205	1,849,048	2,540,911
Silver (oz.)	75,354,443	77,732,911	77,604,483
Platinum and palladium (oz.)	863	936	1,664
Lead (tons)	207,612	205,249	316,591
Copper (lb.)	348,888,000	590,850,000	529,686,000
Spelter (lb.)	14,628,614	44,106,253	15,748,000
Nickel (lb.)	120,080	375,167	356,187
Tin (lb.)	11,915,954	18,511,160	
Sulphuric acid (lb.)	9,952,000	51,688,000	24,296,000
Arsenic (lb.)	5,155,522	17,695,266	6,184,000
Copper sulphate (lb.)	2,237,471	3,618,172	6,798,000
Byproduct metals (lb.)	3,232,488	1,549,426	1,678,228
Sulphur dioxide (lb.)	154,794	8,154,734	

The report also includes the following operating statistics, which are of interest in connection with the decreased earnings and lower volume of production:

	1921	1920	1914
Number of men employed	7,605	13,330	12,179
Total wages and salaries	$11,440,480	$20,164,508	$10,212,591
Average wage per 8-hr. day	$4.17	$5.04	$2.33
Tons charge smelted	2,583,142	4,050,751	4,171,258
Tons bullion refined	357,062	505,535	588,718
Tons coal used	302,924	499,713	544,619
Tons coke used	263,384	394,014	447,761
Barrels fuel oil used	1,432,085	1,294,299	976,528
Cubic feet gas used	837,012,321	2,674,177,277	7,430,300
Tons ore mined	2,205,537	2,311,946	1,266,702
Tons coal mined	360,952	509,424	257,942
Tons coke produced	100,860	181,664	129,650

National Leather Co. Has Small Profit.—The annual report of this company and its subsidiaries for the year 1921 shows total sales amounting to over $23,500,000 and a surplus from earnings of nearly $200,000. Inventories had been reduced to the extent of about $1,000,000.

President George H. Swift, in his letter to stockholders, stated that considerable improvement had been noted during the last months, although the volume of sales had not expanded to the extent expected last October.

"It is apparent that at the present time," according to Mr. Swift, "the biggest problem facing the tanning business is the lack of satisfactory demand from the users of leather. It is exceptional to find a buyer who will anticipate his requirements more than a short time ahead. In other words, practically all buyers are buying in a hand-to-mouth manner, which, however, is a natural sequence after a period of declining prices such as we have gone through in the past two years."

The St. Louis Market

ST. LOUIS, April 14, 1922.

An active market in this locality may still be reported, although there was a temporary lull of a few days shortly after the beginning of the month. A complete recovery has been made, however, and at the present time the volume of business transacted is as good as—in fact, better than—any previous month. There are no important price changes to report at this time, and in general prices are firming up considerably.

ALKALIS

The alkali market has declined somewhat, although *caustic* and *soda ash* maintain a normal basis both in price and demand. *Bicarbonate of soda* has declined quite a bit of late and can now be obtained as much as 35c. per 100 lb. cheaper than 2 weeks ago. Whether this price is as yet reflected in the consumer's purchase remains to be seen but the jobbers have already taken advantage of it.

GENERAL AND SPECIAL CHEMICALS

The heavy *mineral acid* market remains the same, with a good demand and firm prices. *Citric acid* is now coming to life, with a very good demand, and this should continue with the approach of the summer season. There has been no change in the *white arsenic* situation. *Bromides* continue to be in good demand. A brisk demand for *carbon bisulphide* has been reported, with no change in price. The demand for *carbon tetrachloride* is routine. *Copperas* demand is still beyond production, with prices remaining the same; however, one manufacturer has temporarily withdrawn from the market. The previously anticipated slump in *glycerine* has finally made its appearance, and the price has accordingly declined 1c. per lb. Drums are now selling for 15c. per lb. *Sulphur* is holding firm at the same price level of 2 weeks ago, and with an increasing demand. An advance in price might be expected in the near future. The demand for *zinc sulphate technical* is routine, and prices prevailing 2 weeks ago are still in force; however, an advance may be expected at any time.

VEGETABLE OILS AND NAVAL STORES

Castor oil is holding its own with ease, though some spot goods can be had at less than the market price. The *linseed oil* market is showing the effects of heavy importations and American producers are at quite a disadvantage. Our prices have slightly recuperated from the low price of 84c. reached a few days ago and are now being maintained at 86c. Whether the home producers can control the market further is doubtful, and consumers are generally holding back for lower prices. *Turpentine* fluctuates daily, but the variation in price has been rather limited since reaching the low figure of 85c. last week.

PAINT MATERIALS

Paint manufacturers are experiencing a very serious slump just now that has decreased their anticipated demands greatly. *Barytes*, *lithopone* and *zinc* are not moving as would ordinarily be expected at this season, but manage to maintain their price level of a month ago.

The Iron and Steel Market

PITTSBURGH, April 14, 1922.

An unexpected development has occurred in connection with the coal strike inaugurated April 1, as a part of the Connellsville region and by far the major part of the Lower Connellsville region have gone on strike. A few strikes had been expected in the coke region, chiefly or wholly at works that have lately been paying less than the Frick or Steel Corporation wage scale, but there have been many strikes at Frick plants also. The United Mine Workers claim that most of the men are "organized," but the organization is no doubt of more or less makeshift character. On account of the disposition of Connellsville region workers to celebrate the Easter holidays very extensively the operators have taken no steps toward resumption, but next week strenuous efforts will probably be made to operate. Meanwhile the Frick company has moved many willing workmen from the Lower Connellsville to the Connellsville or old basin, putting idle ovens in operation.

No coal or coke, of course, had been stored in the Connellsville region, and little coke was stored at the blast furnaces tributary to Connellsville ovens, the result being that half a dozen or more blast furnaces have been banked or blown out, while orders pending to blow in about the same number have been suspended. The Connellsville and Lower Connellsville regions had been supplying coke for 20 or 25 per cent of the total blast-furnace operations of the country, and the coal shipments were also of some importance to the iron and steel industry.

The results of the Connellsville development must be distinguished from results that would follow exhaustion of the large stocks of coal that exist in the country. It is conceivable, though improbable, that the Connellsville labor troubles might last long enough to produce such a decrease in pig iron and steel production that finishing mills, now well stocked with coal, might be unable to use all the coal, on account of shortage of steel.

The effect of the Connellsville labor troubles upon the iron and steel market has been to cause merchant blast furnaces in several districts to withdraw prices entirely or to make advances of, say, $1 a ton. An extreme case is that of basic pig iron at valley furnaces, which a week ago was quotable at $18 furnace, but has just sold at $20 for 1,000 tons of standard grade and at $19 for 4,000 tons of off grade.

With pig iron stiffening and with coal supplies for the future more or less menaced, steel works have been disposed to become reserved in selling steel products. The Jones & Laughlin Steel Co., whose coal mines are union, has withdrawn entirely from the steel market, as it already had large steel commitments, with a moderate stock of coal. All the independent wire mills have advanced nails, staples and barb wire $2 a ton, making nails $2.50 a keg, but the Steel Corporation wire subsidiary has not followed up to this time. The recently advanced prices in sheets are reported to be fully effective, 2.40c. for blue annealed, 3.15c. for black, 4.15c. for galvanized and 4.50c. for automobile sheets, but as buyers had ample opportunity to cover at the old prices the market is now very quiet. Bars, shapes and plates remain quotable at 1.50c. as the general market.

SELLERS' ATTITUDE STIFFENED

The coal strike, with the ramifications developed, is a new factor, operating to curtail iron and steel production somewhat and to stiffen the attitude of sellers. Steel production had been mounting rapidly. There is an interesting question whether steel production would have continued to increase after April 1 if there had been no coal strike, also a question whether there would have been nearly as much increase in production to April 1 if no coal strike had been on the program. Estimating the rate of steel ingot production month by month on the basis of the monthly reports of the production of thirty producers, and plotting the average rates in the months December to March inclusive, the graph is almost a straight line. The rate in December was about 19,750,000 tons per annum and the rate in March about 32,500,000 tons. Continuing the line to April 1, as seems justified by the news in March, the rate on that date was about 36,000,000 tons. Obviously no such climb could continue for even a few months. Common observation is sufficient to show that actual consumption of steel has not so greatly increased. Presumably consumers in general have fortified themselves against a curtailment of supplies due to the coal strike which the coal strike may not produce even though in its first fortnight it has been more formidable than coal and furnace interests expected.

Limited quantities of Westmoreland County, Pan Handle and Connellsville coal have been in the market in the past week, but asking prices have been mounting and buyers have largely lost interest. Connellsville furnace coke has become unquotable. Occasional odd lots have been offered at fancy prices, while the average furnace will not pay over $3.50 for a supply, preferring to bank. Foundry coke has been available at $4.75@$5.25, against $4.25@$4.75 ruling as the market for several weeks, during which time most foundries were stocking.

General Chemicals

CURRENT WHOLESALE PRICES IN NEW YORK MARKET

		Carlots	Less Carlots
Acetic anhydride	lb.	..... –	$0.38 – $0.40
Acetone	lb.	$0.09 – $0.09½	.09½ – .11
Acid, acetic, 28 per cent	100 lbs.	2.35 – 2.50	2.55 – 3.00
Acetic, 56 per cent	100 lbs.	5.00 – 5.25	5.30 – 5.50
Acetic, glacial, 99½ per cent, carboys, 100 lbs.		9.00 – 9.50	9.75 – 10.00
Boric, crystals	lb.	.11 – .11½	.11½ – .12
Boric, powder	lb.	.11½ – .11¾	.11½ – .12½
Citric	lb.	..... –	.45½ – .46
Hydrochloric	100 lb.	1.10 – 1.20	1.25 – 1.70
Hydrofluoric, 52 per cent	lb.	.11 – .11½	.11½ – .12
Lactic, 44 per cent tech	lb.	.09½ – .10	.10½ – .12
Lactic, 22 per cent tech	lb.	.04 – .04½	.04½ – .05
Molybdic, c.p.	lb.	3.00 – 3.25	3.30 – 3.75
Muriatic, 20 deg. (see hydrochloric)		..... –	..... – .....
Nitric, 40 deg.	lb.	.06 – .06½	.06½ – .07
Nitric, 42 deg.	lb.	.06½ – .06¾	.07 – .07½
Oxalic, crystals	lb.	.11½ – .12	.12½ – .13
Phosphoric, 50 per cent solution	lb.	.08 – .08½	.08½ – .09½
Picric	lb.	.25 – .27	.28 – .32
Pyrogallic, resublimed	lb.	..... –	1.65 – 1.75
Sulphuric, 60 deg., tank cars	ton	11.00 – 12.00	..... – .....
Sulphuric, 60 deg., drums	ton	12.00 – 14.00	..... – .....
Sulphuric, 66 deg., tank cars	ton	17.00 – 17.50	..... – .....
Sulphuric, 66 deg., drums	ton	20.00 – 20.50	21.00 – 22.00
Sulphuric, 66 deg., carboys	ton	..... –	..... – .....
Sulphuric, fuming, 20 per cent (oleum) tank cars	ton	19.50 – 20.00	..... – .....
Sulphuric, fuming, 20 per cent (oleum) drums	ton	22.00 – 22.50	23.00 – 24.00
Sulphuric, fuming, 20 per cent (oleum) carboys	ton	31.00 – 32.00	33.00 – 34.00
Tannic, U. S. P.	lb.	..... –	.60 – .75
Tannic (tech.)	lb.	.40 – .45	.46 – .50
Tartaric, imported crystals	lb.	..... –	.26½ – .28
Tartaric acid, imported, powdered	lb.	..... –	.27½ – .30
Tartaric acid, domestic	lb.	..... –	..... – .30
Tungstic, per lb. of WO	lb.	..... –	1.00 – 1.10
Alcohol, ethyl	gal.	..... –	4.75 – 5.50
Alcohol, methyl (see methanol)		..... –	..... – .....
Alcohol, denatured, 188 proof No. 1	gal.	..... –	.32 – .34
Alcohol, denatured, 188 proof No. 5	gal.	..... –	.32 – .34
Alum, ammonia, lump	lb.	.03½ – .03¾	.04 – .04½
Alum, potash, lump	lb.	.03½ – .04	.04½ – .05
Alum, chrome lump	lb.	.07½ – .08	.08½ – .08¾
Aluminum sulphate, commercial	100 lb.	1.65 – 1.85	1.90 – 2.40
Aluminum sulphate, iron free	lb.	.02½ – .02¾	.03 – .03½
Aqua ammonia, 26 deg., drums (750 lb.)	lb.	.07½ – .07¾	.08 – .08½
Ammonia, anhydrous, cyl. (100-150 lb.)	lb.	.30 – .30½	.31 – .33
Ammonium carbonate, powder	lb.	.07 – .07½	.08 – .09
Ammonium nitrate	lb.	.06 – .06¼	.06½ – .07½
Amylacetate tech	gal.	..... –	2.00 – 2.40
Arsenic, white, powdered	lb.	.06½ – .07½	.07½ – .08
Arsenic, red, powdered	lb.	.12 – .12½	.12½ – .13
Barium chloride	ton	87.00 – 90.00	91.00 – 95.00
Barium dioxide (peroxide)	lb.	.20 – .21	.21½ – .22
Barium nitrate	lb.	.06½ – .07	.07½ – .08½
Barium sulphate (precip.) (blanc fixe)	lb.	.03½ – .04	.04½ – .04½
Blanc fixe, dry	lb.	.04 – .04½	..... – .....
Blanc fixe, pulp	ton	45.00 – 55.00	..... – .....
Bleaching powder	100 lb.	1.60 – 1.75	1.80 – 2.75
Blue vitriol (see copper sulphate)		..... –	..... – .....
Borax	lb.	.05½ – .05¾	.06 – .06½
Brimstone (see sulphur, roll)		..... –	..... – .....
Bromine	lb.	.27 – .28	.28½ – .35
Calcium acetate	100 lbs.	1.75 – 2.00	..... – .....
Calcium carbide	lb.	.04½ – .04¾	.05 – .05½
Calcium chloride, fused, lump	ton	24.00 – 24.50	24.75 – 27.00
Calcium chloride, granulated	lb.	.01½ – .01¾	.02 – .02½
Calcium peroxide	lb.	..... –	1.40 – 1.50
Calcium phosphate, tribasic	lb.	..... –	.15 – .16
Camphor	lb.	..... –	.89 – .91
Carbon bisulphide	lb.	.06 – .06¼	.06½ – .07½
Carbon tetrachloride, drums	lb.	.09½ – .10	.10½ – .12
Carbonyl chloride, (phosgene)	lb.	..... –	.60 – .75
Caustic potash (see potassium hydroxide)		..... –	..... – .....
Caustic soda (see sodium hydroxide)		..... –	..... – .....
Chalk, precip.—domestic, light	lb.	.04½ – .04¾	..... – .....
Chalk, precip.—domestic, heavy	lb.	.03½ – .03¾	..... – .....
Chalk, precip.—imported, light	lb.	.04½ – .05	..... – .....
Chlorine, gas, liquid-cylinders (100 lb.)	lb.	.06 – .06½	.06½ – .07
Chloroform	lb.	..... –	.37 – .40
Cobalt oxide	lb.	..... –	2.00 – 2.10
Copperas	ton	15.00 – 16.00	16.50 – 30.00
Copper carbonate, green precipitate	lb.	.19 – .20	.20½ – .21
Copper cyanide	lb.	..... –	.58 – .60
Copper sulphate, crystals	100 lb.	5.50 – 5.60	5.65 – 6.15
Cream of tartar	lb.	..... –	.23½ – .25
Epsom salt (see magnesium sulphate)		..... –	..... – .....
Ethyl acetate com. 85%	gal.	..... –	.60 – .65
Ethyl acetate, pure (acetic ether, 98% to 100%)	gal.	..... –	.93 – 1.00
Formaldehyde, 40 per cent	lb.	.08½ – .09	.09½ – .10
Fullers earth, f.o.b. mines	net ton	16.00 – 17.00	..... – .....
Fullers earth—imported powdered—net	ton	30.00 – 32.00	..... – .....
Fusel oil, ref	gal.	..... –	2.15 – 2.50
Fusel oil, crude	gal.	..... –	1.25 – 1.50
Glauber's salt (see sodium sulphate)		..... –	..... – .....
Glycerine, c. p. drums extra	lb.	..... –	.15 – .15½
Iodine, resublimed	lb.	..... –	4.05 – 4.15
Iron oxide, red	lb.	..... –	.12 – .18
Lead acetate	lb.	..... –	.09½ – .12
Lead arsenate, powd	lb.	.14 – .14½	.14½ – .15½
Lead nitrate	lb.	..... –	.15 – .20
Litharge	lb.	.07½ – .07¾	.08 – .08½
Magnesium carbonate, technical	lb.	.06 – .06¼	.06½ – .08
Magnesium sulphate, U. S. P.	100 lb.	2.50 – 2.60	2.65 – 2.85
Magnesium sulphate, technical	100 lb.	..... –	1.00 – 1.80
Methanol, 95%	gal.	..... –	.57 – .58
Methanol, 97%	gal.	..... –	.59 – .60
Nickel salt, double	lb.	..... –	.11 – .11½
Nickel salt, single	lb.	..... –	.11 – .11½
Phosgene (see carbonyl chloride)		..... –	..... – .....
Phosphorus, red	lb.	.45 – .46	.47 – .50
Phosphorus, yellow	lb.	..... –	.30 – .35
Potassium bichromate	lb.	.10½ – .10¾	.10½ – .10¾
Potassium bromide, granular	lb.	..... –	.17 – .23
Potassium carbonate, U. S. P.	lb.	.12 – .12½	.13 – .16
Potassium carbonate, 80–85%	lb.	.05 – .05½	.05½ – .06
Potassium chlorate, crystals	lb.	.06 – .06½	.06½ – .08
Potassium cyanide	lb.	..... –	.42 – .45
Potassium hydroxide (caustic potash)	100 lb.	5.75 – 6.00	6.10 – 7.00
Potassium iodide	lb.	..... –	3.10 – 3.15
Potassium nitrate	lb.	.07½ – .07¾	.08 – .09
Potassium permanganate	lb.	.15 – .15½	.16 – .22
Potassium prussiate, red	lb.	nominal	nominal
Potassium prussiate, yellow	lb.	.25½ – .26	.26½ – .27
Rochelle salts (see sodium potas. tartrate)		..... –	..... – .....
Salammoniac, white, granular	lb.	.07 – .07½	.07½ – .08
Salammoniac, gray, granular	lb.	.07½ – .07¾	.08 – .08½
Salsoda	100 lb.	1.45 – 1.55	1.60 – 1.85
Salt cake (bulk)	ton	18.00 – 20.00	..... – .....
Soda ash, light	100 lb.	1.80 – 2.00	2.05 – 2.60
Soda ash, dense	100 lb.	1.85 – 1.95	2.00 – 2.50
Sodium acetate	lb.	.04½ – .04¾	.04½ – .05
Sodium bicarbonate	100 lb.	1.80 – 1.90	1.95 – 2.40
Sodium bichromate	lb.	.07½ – .07¾	.08 – .08½
Sodium bisulphate (nitre cake)	ton	4.50 – 4.60	4.65 – 5.50
Sodium bisulphite powdered, U.S.P.	lb.	.04½ – .04¾	.04½ – .05½
Sodium chlorate	lb.	.06½ – .07	.07½ – .07¾
Sodium chloride	long ton	12.00 – 13.00	..... – .....
Sodium cyanide	lb.	.22 – .23	.23½ – .27
Sodium fluoride	lb.	.09½ – .10	.10½ – .10½
Sodium hydroxide (caustic soda)	100 lb.	3.65 – 3.70	3.75 – 4.20
Sodium hyposulphite	lb.	.03 – .03½	.03½ – .03¾
Sodium nitrite	lb.	.08½ – .08¾	.09 – .09½
Sodium peroxide, powdered	lb.	.28 – .30	.31 – .35
Sodium phosphate, dibasic	lb.	.03½ – .04	.04½ – .04½
Sodium potassium tartrate (Rochelle salts)	lb.	..... –	.18 – .21
Sodium prussiate, yellow	lb.	.16½ – .16¾	.17 – .17½
Sodium silicate, solution (40 deg.)	100 lb.	.85 – 1.00	1.05 – 1.15
Sodium silicate, solution (60 deg.)	100 lb.	2.35 – 2.50	2.55 – 2.90
Sodium sulphate, crystals (glaubers salt)	100 lbs.	.85 – 1.00	1.10 – 1.50
Sodium sulphide, fused, 60-62 per cent (conc.)	lb.	.04½ – .04¾	.04½ – .05½
Sodium sulphite, crystals	lb.	.03½ – .03¾	.03½ – .04½
Strontium nitrate, powdered	lb.	.09½ – .10	.10½ – .12
Sulphur chloride, yellow	lb.	.04½ – .05	.05½ – .06
Sulphur, crude	ton	18.00 – 20.00	..... – .....
Sulphur dioxide, liquid, cylinders extra	lb.	.08 – .08½	.09 – .10
Sulphur (sublimed), flour	100 lb.	..... –	2.25 – 3.10
Sulphur, roll (brimstone)	100 lb.	..... –	2.00 – 2.75
Talc—imported	ton	30.00 – 40.00	..... – .....
Talc—domestic powdered	ton	18.00 – 25.00	..... – .....
Tin bichloride	lb.	.09 – .09½	.09½ – .10
Tin oxide	lb.	..... –	.37 – .38
Zinc carbonate	lb.	.14 – .14½	.14½ – .15½
Zinc chloride, gran.	lb.	.05½ – .06	.06½ – .06½
Zinc cyanide	lb.	.42 – .44	.45 – .47
Zinc oxide, XX	lb.	.07½ – .08	.08½ – .08½
Zinc sulphate	100 lb.	2.75 – 3.00	3.05 – 3.30

Coal-Tar Products

NOTE—The following prices are for original packages in large quantities:

Alpha-naphthol, crude	lb.	$1.00 — $1.05
Alpha-naphthol, refined	lb.	1.10 — 1.15
Alpha-naphthylamine	lb.	.30 — .31
Aniline oil, drums extra	lb.	.16 — .16½
Aniline salts	lb.	.24 — .26
Anthracene, 80% in drums (100 lb.)	lb.	.75 — 1.00
Benzaldehyde U.S.P.	lb.	1.25 — 1.30
Benzidine, base	lb.	.85 — .95
Benzidine sulphate	lb.	.75 — .85
Benzoic acid, U.S.P.	lb.	.60 — .65
Benzoate of soda, U.S.P.	lb.	.55 — .57
Benzene, pure, water-white, in drums (100 gal.)	gal.	.29 — .35
Benzene, 90%, in drums (100 gal.)	gal.	.27 — .32
Benzyl chloride, 95-97%, refined	lb.	.25 — .27
Benzyl chloride, tech	lb.	.20 — .23
Beta-naphthol benzoate	lb.	3.75 — 4.00
Beta-naphthol, sublimed	lb.	.60 — .65
Beta-naphthol, tech	lb.	.26 — .28
Beta-naphthyla mine, sublimed	lb.	1.50 — 1.60
Cresol, U. S. P., in drums (100 lb.)	lb.	.12 — .15
Ortho-cresol, in drums (100 lb.)	lb.	.16 — .18
Cresylic acid, 97–99%, straw color, in drums	gal.	.53 — .55
Cresylic acid, 95-97%, dark, in drums	gal.	.48 — .50
Dichlorbenzene	lb.	.06 — .09
Diethylaniline	lb.	.95 — 1.00
Dimethylaniline	lb.	.38 — .40
Dinitrobenzene	lb.	.23 — .25
Dinitroclorbenzene	lb.	.23 — .25
Dinitronaphthalene	lb.	.30 — .32
Dinitrophenol	lb.	.33 — .35
Dinitrotoluene	lb.	.22 — .24
Dip oil, 25%, car lots, in drums	gal.	.24 — .26
Diphenylamine	lb.	.59 — .65
H-acid	lb.	.85 — 1.00
Meta-phenylenediamine	lb.	.90 — 1.00
Monochlorbenzene	lb.	.14 — .15
Monoethylaniline	lb.	1.20 — 1.25
Naphthalene crushed, in bbls.	lb.	.06 — .06½
Naphthalene, flake	lb.	.06½ — .07
Naphthalene, balls	lb.	.08 — .08½
Naphthionic acid, crude	lb.	.65 — .70
Nitrobenzene	lb.	.10 — .12
Nitro-naphthalene	lb.	.30 — .35
Nitro-toluene	lb.	.15 — .17½
Ortho-amidophenol	lb.	2.75 — 2.80
Ortho-dichlor-benzene	lb.	.15 — .20
Ortho-nitro-phenol	lb.	.75 — .80
Ortho-nitro-toluene	lb.	.12 — .15
Ortho-toluidine	lb.	.16 — .20
Para-amidophenol, base	lb.	1.25 — 1.30
Para-amidophenol, HCl	lb.	1.30 — 1.35
Para-dichlorbenzene	lb.	.15 — .18
Paranitroaniline	lb.	.75 — .77
Para-nitrotoluene	lb.	.70 — .75
Para-phenylenediamine	lb.	1.50 — 1.55
Para-toluidine	lb.	1.10 — 1.15
Phthalic anhydride	lb.	.35 — .38

Phenol, U. S. P., drums	lb.	.12 —	.15
Pyridine	gal.	1.75 —	2.75
Resorcinol, technical	lb.	1.30 —	1.35
Resorcinol, pure	lb.	1.75 —	1.80
Salicylic acid, tech., in bbls	lb.	.24 —	.24½
Salicylic acid, U. S. P	lb.	.25 —	.26
Solvent naphtha, water-white, in drums, 100 gal	gal.	.25 —	.28
Solvent naphtha, crude, heavy, in drums, 100 gal	gal.	.10 —	.12
Sulphanilic acid, crude	lb.	.25 —	.27
Tolidine	lb.	1.20 —	1.30
Toluidine, mixed	lb.	.30 —	.35
Toluene, in tank cars	gal.	.25 —	.28
Toluene, in drums	gal.	.30 —	.35
Xylidines, drums, 100 gal	lb.	.40 —	.45
Xylene, pure, in drums	gal.	.40 —	.45
Xylene, pure, in tank cars	gal.	.45 —	....
Xylene, commercial, in drums, 100 gal	gal.	.33 —	.35
Xylene, commercial, in tank cars	gal.	.30 —	....

Waxes

Prices based on original packages in large quantities.

Bayberry Wax	lb.	$0.20 —	$0.21
Beeswax, refined, dark	lb.	.26 —	.28
Beeswax, refined, light	lb.	.30 —	.32
Beeswax, white pure	lb.	.35 —	.40
Candellila, wax	lb.	.25 —	.26
Carnauba, No. 1	lb.	.45 —	.46
Carnauba No. 2, North Country	lb.	.25 —	.25½
Carnauba, No. 3, North Country	lb.	.16 —	.16½
Japan	lb.	.17 —	.18
Montan, crude	lb.	.04½ —	.04½
Paraffine waxes, crude match wax (white) 105-110 m.p.	lb.	.04½ —	.04½
Paraffine waxes, crude, scale 124-126 m.p.	lb.	.02½ —	....
Paraffine waxes, refined, 118-120 m.p.	lb.	.03 —	.03½
Paraffine waxes, refined, 125 m.p.	lb.	.03½ —	.03½
Paraffine waxes, refined, 128-130 m.p.	lb.	.04 —	.04½
Paraffine waxes, refined, 133-135 m.p.	lb.	.04½ —	.04½
Paraffine waxes, refined, 135-137 m.p.	lb.	.05 —	.05½
Stearic acid, single pressed	lb.	.08½ —	.09
Stearic acid, double pressed	lb.	.09½ —	.09½
Stearic acid, triple pressed	lb.	.10½ —	.10½

Naval Stores

All prices are f.o.b. New York unless otherwise stated, and are based on carload lots. The oils in 50-gal. bbls., gross weight, 500 lb.

Rosin B-D, bbl	280 lb.	$5.30 —	5.35
Rosin E-I	280 lb.	5.40 —	5.45
Rosin K-N	280 lb.	5.50 —	6.60
Rosin W. G.-W. W	280 lb.	7.00 —	7.25
Wood rosin, bbl	280 lb.	6.25 —	.....
Spirits of turpentine	gal.	.88 —	.....
Wood turpentine, steam dist	gal.	.85 —	.....
Wood turpentine, dest. dist	gal.	.70 —	.70
Pine tar pitch, bbl	200 lb.	..... —	6.00
Tar, kiln burned, bbl. (500 lb.)	bbl.	..... —	9.50
Retort tar, bbl	500 lb.	—	9.00
Rosin oil, first run	gal.	.36 —	.....
Rosin oil, second run	gal.	.38 —	.....
Rosin oil, third run	gal.	.46 —	.....
Pine oil, steam dist., sp.gr., 0.930-0.940	gal.		$1.90
Pine oil, pure, dest. dist	gal.		1.50
Pine tar oil, ref., sp.gr. 1.025-1.035	gal.		.46
Pine tar oil, crude, sp.gr. 1.025-1.035 tank cars f.o.b. Jacksonville, Fla	gal.		.35
Pine tar oil, double ref., sp.gr. 0.965-0.990	gal.		.75
Pine tar, ref., thin, sp.gr., 1.080-1.960	gal.		.35
Turpentine, crude, sp. gr., 0.900-0.970	gal.		1.25
Hardwood oil, f.o.b. Mich., sp.gr., 0.960-0.990	gal.		.35
Pinewood creosote, ref	gal.		.52

Fertilizers

Ammonium sulphate, f.a.s., N.Y	100 lb.	3.75	
Blood, dried, f.o.b., N. Y	unit	4.00	
Bone, 3 and 50, ground, raw	ton	30.00 —	32.00
Fish scrap, dom., dried, f.o.b. works	unit	3.10 —	3.20
Nitrate soda	100 lb.	2.90 —	3.00
Tankage, high grade, f.o.b. Chicago	unit	3.25 —	3.40
Phosphate rock, f.o.b. mines, Florida pebble, 68-72%	ton	5.50 —	7.00
Tennessee, 78-80%	ton	8.50 —	9.00
Potassium muriate, 80%	ton	33.50 —	35.00
Potassium sulphate	unit	1.00 —	.....

Crude Rubber

Para—Upriver fine	lb.	$0.17½ —	.17½
Upriver coarse	lb.	.12 —	.13
Upriver caucho ball	lb.	.12½ —	.13
Plantation—First latex crepe	lb.	.14½ —	.15
Ribbed smoked sheets	lb.	.14½ —	.15
Brown crepe, thin, clean	lb.	.13 —	....
Amber crepe No. 1	lb.	.15 —	....

Oils

VEGETABLE

The following prices are f.o.b. New York for carload lots.

Castor oil, No. 3, in bbls	lb.	$0.10 —	$0.10½
Castor oil, AA, in bbls	lb.	.11½ —	.12
China wood oil, in bbls	lb.	.13 —	.13½
Coconut oil, Ceylon grade, in bbls	lb.	.08½ —	.09
Coconut oil, Cochin grade, in bbls	lb.	.09½ —	.09½
Corn oil, crude, in bbls	lb.	.11 —	.11½
Cottonseed oil, crude (f. o. b. mill)	lb.	.10 —	.10½
Cottonseed oil, summer yellow	lb.	.12 —	.12½
Cottonseed oil, winter yellow	lb.	.13½ —	.13
Linseed oil, raw, car lots (domestic)	gal.	.82 —	.83
Linseed oil, raw, tank cars (domestic)	gal.	.78 —	.79
Linseed oil, in 5-bbl lots (domestic)	gal.	.85 —	.86
Olive oil, denatured	gal.	1.12 —	1.15½
Palm, Lagos	lb.	.07½ —	.08
Palm, Niger	lb.	.06 —	.06½
Peanut oil, crude, tank cars (f.o.b. mill)	lb.	.09½ —	.10
Peanut oil, refined, in bbls	lb.	.12½ —	.13
Rapeseed oil, refined in bbls	gal.	.83 —	.84
Rapeseed oil, blown, in bbls	gal.	.86 —	.87
Soya bean oil (Manchurian), in bbls. N. Y	lb.	.10½ —	....
Soya bean oil, tank cars, f.o.b., Pacific coast	lb.	.09½ —	....

FISH

Light pressed menhaden	gal.	$0.54 —	....
Yellow bleached menhaden	gal.	.57 —	....
White bleached menhaden	gal.	.56 —	....
Blown menhaden	gal.	.61 —	....

Miscellaneous Materials

Prices remain quotably unchanged.

Refractories

All quotations same as April 5th report.

Ferro-Alloys

Ferromanganese 76-80% Mn, domestic $67 per ton.
All other prices remain unchanged.

Ores and Semi-finished Products

Quotation same as previous report.

Non-Ferrous Metals

New York Markets

	Cents per Lb.
Copper, electrolytic	12.875
Aluminum, 98 to 99 per cent	19.00
Antimony, wholesale lots, Chinese and Japanese	4.50–5.00
Nickel, ordinary (ingot)	41.00
Nickel, electrolytic	44.00
Nickel, electrolytic, resale	32.00
Monel metal, shot and blocks	32.00
Monel metal, ingots	35.00
Monel metal, sheet bars	38.00
Tin, 5-ton lots, Straits	30.25
Lead, New York, spot	5.00–5.15
Lead, E. St. Louis, spot	4.85–4.90
Zinc, spot, New York	5.40
Zinc, spot, E. St. Louis	4.90

OTHER METALS

Silver (commercial)	oz.	$0.65½
Cadmium	lb.	1.00–1.10
Bismuth (500 lb. lots)	lb.	2.00@2.10
Cobalt	lb.	3.00@3.25
Magnesium	lb.	1.15
Platinum	oz.	85.00@ 90.00
Iridium	oz.	160.00@170.00
Palladium	oz.	55.00@ 60.00
Mercury .75	lb.	50.00

OLD METALS—The following are the dealers' purchasing prices in cents per pound:

	New York Current
Copper, heavy and crucible	10.25@10.50
Copper, heavy and wire	10.00@10.25
Copper, light and bottoms	7.75@ 8.25
Lead, heavy	3.60@ 3.85
Lead, tea	3.00@ 3.25
Brass, heavy	4.50@ 4.75
Brass, light	4.00@ 4.25
No. 1 yellow brass turnings	4.00@ 4.25
Zinc	2.25@ 2.50

Structural Material

The following base prices per 100 lb. are for structural shapes 3 in. by ¼ in. and arger, and plates ¼ in. and heavier, from jobbers' warehouses in the cities named:

	New York*	Chicago
Structural shapes	$2.48	$2.38
Soft steel bars	2.38	2.28
Soft steel bar shapes	2.38	2.28
Soft steel bands	2.98	2.88
Plates, ¼ to 1 in. thick	2.48	2.38

*Add 15c per 100 lb. for trucking to Jersey City and 10c for delivery in New York and Brooklyn.

Industrial

Financial, Construction and Manufacturers' News

Construction and Operation

Alabama

BIRMINGHAM—The Dixie Chemical Products Co., is planning for the erection of a new addition to its plant. D. H. Markstein is president.

TUSCALOOSA—J. H. Thress has construction nearing completion on a new brick-manufacturing plant and will install equipment and start operation at an early date. The site is on the outskirts of the city. The plant will cost about $22,000.

EUFAULA—The City Council is planning for the installation of a new filtration plant and system at the waterworks.

Arkansas

EL DORADO—The El Dorado Oil & Pipe Line Co. is planning for the rebuilding of the portion of its oil plant, recently destroyed by fire.

California

RICHMOND—The Luning Mineral Products Co., 21st St. and Chanslor Ave., manufacturer of mineral pigments used for paint production, has plans under way for the construction of an addition to its plant to more than double the present output.

Colorado

DENVER—The Continental Rubber Corp., recently organized under state laws, has negotiations in progress for the purchase of a local site to be used for the construction of a new plant for the manufacture of automobile tires and other rubber goods. A. E. Sidnell is president and treasurer.

Connecticut

VERSAILLES—The Inland Paper Board Co., Inc. recently organized, has taken over the local plant of the Federal Paper Board Co., comprising a number of buildings and over 600 acres of land, and in the future will operate at this location for the manufacture of composition paper-board specialties. A number of improvements will be made in the mill, including the erection of a 1-story power house. The new company is headed by William G. Shortess and Frank Mousley.

Delaware

YORKLYN—The National Fibre & Insulation Co. is arranging for the discontinuance of the plant of the American Vulcanized Fibre Co., at Newark, Del., recently acquired, devoted to paper manufacture and kindred production, and will combine the mill with its main plant at Yorklyn.

Florida

ORLANDO—The Orlando Pottery, operated by the Yowell-Drew Co., is having plans drawn for the erection of an addition, to include a new kiln. The equipment installation is estimated to cost close to $13,000. Bids will be asked early in May. Gamble & Bryan, East Liverpool, O., are engineers. N. P. Yowell is president.

HOMESTEAD—Fire, April 2, destroyed a portion of the local building of the Independent Fertilizer Co., with loss estimated at about $13,000.

Georgia

COLUMBUS—The Bradley Fertilizer Co., 8th St. and Tenth Ave., is reported to be planning for the immediate rebuilding of the portion of its plant destroyed by fire, March 24, with loss estimated at $90,000, including equipment.

Illinois

CHICAGO—The Byproducts & Coke Corp., 112th St. and Torrance Ave., has commenced the construction of a new 1-story coke-oven plant, 20 x 550 ft. Charles Stewart, 53 West Jackson Blvd., is engineer.

Indiana

MISHAWAKA—The Rubber Regeneration Co. is planning for the rebuilding of the section of its plant destroyed by fire, March 28. The loss has not been announced.

Iowa

DAVENPORT—The recent reference to the fire loss sustained at the plant of the Mammoth Glucose Co., March 30, reported at $300,000, occurred at the works Nichols Wire & Sheet Co., occupying a portion of the glucose plant under lease, and in a section owned by Charles Brady, who purchased the entire plant from the Corn Products Refining Co., the previous owner.

Kentucky

RUSSELL — The Kentucky Refractories Corp., Covington, Ky., has acquired property at Russell, totaling about 15 acres of land, and plans for the erection of a branch plant for the manufacture of firebrick, furnace linings and other refractory products. The works will be equipped for an output of about 75,000 bricks and other refractory units daily, giving employment to approximately 175 men. The cost is estimated at about $350,000, including machinery. A. J. Ivey is secretary and treasurer.

Louisiana

HOMER—The local refinery and oil plant of the Homer Oil & Refining Co. has been acquired by H. C. Leete and A. C. Lea, both of Shreveport, La., who will organize a company and operate the plant. The refinery will be remodeled and improved.

HOUMA—The City Council is planning for the construction of a new purification plant at the municipal waterworks. A bond issue of $200,000 has been voted for this and other municipal improvements.

Michigan

GRAND RAPIDS—The Valley City Milling Co., 217 Michigan St., has completed plans and will soon call for bids for the erection of a new flour mill to cost about $600,000, including equipment. The A. E. Baxter Engineering Co., Ellicott Square, Buffalo, N. Y., is engineer. William S. Rowe is president.

MONROE—Fire, April 2, destroyed the plant of the Weis Fibre Container Co., with loss estimated at about $1,000,000. The plant has been giving employment to about 300 men. It is planned to rebuild at an early date.

Missouri

ANNAPOLIS—The Annapolis Lead Co. will soon break ground for the erection of a new concentrating plant, to be equipped for a daily production of about 1,000 tons. A power house will also be constructed. The work is estimated to cost in excess of $400,000. M. C. Rhodes is president.

PHENIX—The Phenix Marble Co. is pushing construction on its new local plant and plans for early occupancy. It will be equipped for the manufacture of lime products, whiting and kindred specialties, and is estimated to cost $60,000.

JEFFERSON CITY—The Strawboard Mfg. Co. has preliminary plans under way for the erection of an addition to its plant.

New Jersey

PASSAIC—The Paterson Parchment Paper Co., 35 8th St., has awarded a contract to William Hassan, 625 Main St., for the erection of a 2-story addition, to cost about $50,000. The Solomon-Abbott Co., 175 5th Ave., New York, N. Y., is engineer.

EAST RUTHERFORD—Fire, April 10, destroyed two buildings at the plant of the Flintkote Co., Madison and Central Aves., manufacturer of asphalt shingles, waterproofing products, etc., with loss estimated at close to $100,000. Headquarters of the company are at 85 Pearl St., Boston, Mass.

KEYPORT—The County Gas Co., formerly the Standard Gas Co., is planning for extensions and improvements in its local water gas plant, to cost about $150,000. William J. Clothier is vice-president.

New York

FREEVILLE—The United Fertilizer & Lime Co., Merchants' Bank Bldg., Syracuse, N. Y., will build a new 1-story fertilizer manufacturing plant at Freeville, 45 x 75 ft.

OAKFIELD—The United States Gypsum Co., 1170 Broadway, New York, will build a new addition to its plant at Oakfield, used for the manufacture of panel boards and other gypsum products.

Pennsylvania

PHILADELPHIA—The Belmont Packing & Rubber Co., Butler and Sepviva Sts., manufacturer of mechanical rubber products, will break ground at once for the erection of a 2-story addition, 35 x 75 ft. The building contract has been let to George W. Crossley, 2264 Bridge St.

HAZLETON—The Thomas Leather Co. has been organized to take over and operate the plant of William Olewine, 9 East Broad St. Possession will be taken at once, and a number of improvements are contemplated. The new company is headed by Herbert F. and T. Frank Thomas.

South Carolina

CHARLESTON—The Consolidated Gas Co. is planning for extensions and improvements in its plant to cost about $40,000. A new purifier department to cost $25,000 will be installed.

Tennessee

KNOXVILLE—The Kinney Chemical Co., 727 Broadway, is planning for the erection of a 2-story plant, 25 x 150 ft. About 6,500 sq.ft. will be given over to chemical manufacture. F. L. Kinney is head.

Texas

DALLAS—John J. Simmons has awarded a contract to Lawrence Miller, Dallas, for the erection of a 3-story and basement plant for the manufacture of chemicals and chemical byproducts, estimated to cost about $50,000. Barglebaugh & Whitman, Dallas, are architects.

DALLAS—The Trinity Paper Mills Co., 3010 Williams St., is arranging a list of equipment for installation at its plant to provide for a capacity of about 4 tons of waxed and other papers per day. The machinery will include waxing equipment, slitters, winders, etc. J. Y. Webb is president, and R. G. Smythe, manager.

FREEPORT—The Freeport Sulphur Co. has commissioned Dwight P. Robinson & Co., engineers and contractors, 125 East 46th St., New York, N. Y., to prepare plans for its proposed new plant at Hoskins Mound, near Brazaria, Tex., on property recently leased from the Texas Co. It will cost approximately $500,000, with machinery.

CAMERON—The Cameron Water, Power & Light Co. is planning for the installation of a new water treatment and purification plant at its local waterworks, estimated to cost about $40,000.

HOUSTON—The Model Brick Co., recently organized, has plans under way for the erection of a new plant for the manufacture of brick and other burned clay products, and will take bids for the buildings and equipment during May. The initial output will approximate 12,000 bricks per day. W. J. Carter and J. F. Meyer, both of Houston, head the company.

THREE RIVERS—The Three Rivers Glass Co., 520 Bedell Bldg., San Antonio, Tex., recently organized, is having plans prepared for the erection of its proposed new plant at Three Rivers, consisting of a main building, 50 x 150 ft., and auxiliary structures. The company will specialize in the manufacture of bottles, and will develop an output of about 100 gross per day. Automatic glass-blowing machinery and other equipment will be installed. James Kepp is president, and H. L. Warrick, general manager.

West Virginia

WHEELING—The City Council has called a special election on April 24, to vote bonds for $2,000,000 for water-works extensions and improvements, including a new filtration plant. The Board of Water Commissioners is in charge.

Wisconsin

PARK FALLS—The Flambeau Paper Co. is perfecting plans for the rebuilding of its 2-story pulp and paper mill, estimated to cost about $100,000. Work will be commenced at an early date. Thomas W. Orbison, 812 College Ave., Appleton, Wis., is engineer. Guy Waldo is general manager.

New Companies

THE FLORIDA GLASS & NOVELTY WORKS, INC., Jacksonville, Fla., has been incorporated with a capital of $20,000, to manufacture glass specialties. C. E. Harris is president; Charles A. Powers, vice-president; and Harry W. Herwig, secretary and treasurer, all of Jacksonville.

THE K-B MFG. CO., Trenton, N. J., has been incorporated with a capital of $125,000, to manufacture alkalis and kindred products. The incorporators are Abraham S. Lewis and Harry Chait. The company is represented by Alexander Budson, 901 American Mechanic Bank Bldg., Trenton.

THE AMERICAN BRICK CO., INC., Berlin, Conn., has been incorporated with a capital of $75,000, to manufacture brick and other burned clay products. The incorporators are E. M., M. F. and George A. Pickett, all of Berlin.

BARCAN & ZIEGLER, INC., New York, N. Y., has been incorporated with a capital of $50,000, to manufacture chemicals, chemical byproducts, dyes, etc. The incorporators are E. D. Ziegler, M. Reiber and I. Barcan. The company is represented by Louis Levy, 277 Broadway, New York.

THE HARLEM RUBBER CO., 1652 North Kostner Ave., Chicago, Ill., has been incorporated with a capital of $10,000, to manufacture rubber products. The incorporators are George C. Siebert and Joseph A. Netzel.

THE VERTOXEL PRODUCTS CO., Newark, N. J., has been incorporated with a capital of 500 shares of stock, no par value, to manufacture bleaching powders and kindred products. The incorporators are Walter Marvin, 13 Margaretta St., Newark; Henry I. Tanner and Otto Eckert.

THE ORIENTAL LABORATORIES, INC., Memphis, Tenn., has been incorporated with a capital of $5,000, to manufacture chemicals and chemical byproducts. The incorporators are C. L. Gibbes, W. H. Steadman and W. H. Daniel, all of Memphis.

THE VELLEY CHEMICAL CO., Wilmington, Del., has been incorporated under state laws with capital of $3,000,000, to manufacture chemicals and chemical byproducts. The company is represented by the Corporation Service Co., Wilmington.

THE APUL TOWNSEND LABORATORIES, INC., New York, N. Y., has been incorporated with a capital of $275,000, to manufacture lubricants and affiliated products. The incorporators are W. E. Townsend, A. J. Paluszek and E. H. Paul. The company is represented by R. J. Mullen, 192 State St., Brooklyn, N. Y.

THE CONSUMERS' SERVICE CO., Pittsburgh, Pa., is being organized by W. J. Woolums, C. C. Bowker and L. W. Bowker, to manufacture refined petroleum products. Application for a state charter will be made on April 24. The company is represented by W. G. Heiner, 602 Frick Bldg., Pittsburgh.

THE MAGNESITE PRODUCTS CO., 31st and Cicero Sts., Chicago, Ill., has been incorporated with a capital of $50,000, to manufacture magnesite, lime, cement, etc. The incorporators are A. J. Petit, Frederick W. Snider and Edmund S. Cummings.

THE WONDER MINERAL & CHEMICAL CO., 3127 Park Blvd., Detroit, Mich., has been chartered under state laws to manufacture chemicals, chemical byproducts, etc. The incorporators are Warren W. Alger, James F. Williams and John Blenk.

THE DAMASCUS REFINING & MFG. CO., New York, N. Y., has been incorporated under Delaware laws with capital of $5,000,000, to manufacture refined petroleum products. The company is represented by the United States Corporation Co., 65 Cedar St., New York.

THE ELWOOD BRASS & ALUMINUM MFG. CO., Elwood, Ind., has been incorporated with a capital of $20,000, to manufacture brass, bronze and aluminum products. The incorporators are C. P. Rush, Henry Nauman, R. T. Boston and O. D. Hinshaw, all of Elwood.

THE FARMERS' & GINNERS' OIL MILL, INC., Austin, Tex., has been incorporated with a capital of $200,000, to manufacture cotton oil products. The incorporators are Leigh Ellis, H. Wunderlich and G. C. Quinn, all of Austin.

THE BRADLEY OIL CO., Wilmington, Del., has been incorporated under state laws with a capital of $4,000,000, to manufacture refined petroleum products. The company is represented by the Corporation Trust Co. of America, du Pont Bldg., Wilmington.

THE TEXTILE CHEMICAL CO., INC., Providence, R. I., has been incorporated with a capital of $50,000, to manufacture chemicals, dyes and kindred products. The incorporators are Frank S. Shapiro, Mark Weisberg and Philip W. Lown, 5 Mt. Vernon St., Providence.

THE GRIFFITH-CUSTER STEEL CO., Johnstown, Pa., has been incorporated with a capital of $60,000, to manufacture steel products. Benjamin F. Custer, Johnstown, is treasurer.

THE ELDORADO DEVELOPMENT CO., Eldorado Springs, Mo., has been incorporated with a capital of $300,000, to construct and operate a lead and zinc mill and smelter. A. B. Stricklett is president, and L. T. Dunaway, secretary, both of Eldorado Springs.

THE QUALITOL LABORATORIES, INC., Buffalo, N. Y., has been incorporated with a capital of $100,000, to manufacture chemicals and affiliated products. The incorporators are O. C. McFarland and M. E. Buie. The company is represented by Coatsworth & Diebold, 438 Main St., Buffalo.

THE A. W. LEE OIL CO., Oklahoma City, Okla., has been incorporated with a capital of $100,000, to manufacture petroleum products. The incorporators are A. W. and R. G. Lee, both of Oklahoma City.

THE FOURLOCK TILE CORP., Tuckahoe, N. Y., has been incorporated with a capital of $10,000, to manufacture tile and other burned clay products. The incorporators are J. Goldberg and C. F. Bailey. The company is represented by A. S. Mortimer, 111 Broadway, New York.

THE ACME COLOR CO., Boston, Mass., has filed notice of organization to manufacture chemicals, colors, etc. The company is headed by William W. Schofield, 97 High St., Boston.

THE OHIO VALLEY ROCK ASPHALT CO., Summit, Ky., has been incorporated with a capital of $500,000, to operate an asphalt mining and refining plant. The incorporators are R. G. Price, Joseph S. Laurent and Dover Williams, Fountain City, Tenn.

THE J. C. O'CONNOR CO., INC., Pittsburgh, Pa., has been incorporated with a capital of $100,000, to manufacture sheet steel products. H. E. Askin, 1825 Webster Ave., Pittsburgh, is treasurer.

THE GULF PHOSPHATE CORP., Dover, Del., has been incorporated under state laws with capital of $18,750,000, to operate a phosphate mining plant, manufacture fertilizer products, etc. The company is represented by the United States Corporation Co., 65 Cedar St., New York, N. Y.

THE LOTZ ASBESTOS CO., Hartford, Conn., has been incorporated with a capital of $100,000, to manufacture asbestos products. The incorporators are A. V. Nyquist, C. A. Jordan, Jr., and John Lotz, Jr., 94 Beacon St., Hartford.

THE DIXIE CO., Fairmont, W. Va., has been incorporated with a capital of $10,000, to manufacture lubricating oils. C. H. Neill is president; G. G. Smith, vice-president; and J. D. Alexander, secretary, all of Fairmont.

THE VENEZUELAN PETROLEUM CO., Pearl River, N. Y., has been incorporated under Delaware laws with capital of $5,000,000, to manufacture petroleum products. The company is represented by the Registrar & Transfer Co., 900 Market St., Wilmington, Del.

THE MCGREGOR OIL & MFG. CO., McGregor, Tex., has been incorporated with a capital of $50,000, to manufacture oil products. The incorporators are H. E. Hackney, J. D. Naler and C. P. Shaffer, all of McGregor.

THE HOOSIER PAPER CO., Marion, Ind., has been incorporated with a capital of $25,000, to manufacture paper products. The incorporators are P. W. Slevin, Andrew Scheerer and C. C. Nelson, all of Marion.

THE JEWELL OIL CO., Lexington, Ky., has been incorporated under Delaware laws with capital of $100,000, to manufacture petroleum products. The incorporators are John B. and M. H. W. Jewell, and Harry M. Rowe, Lexington. The company is represented by the Colonial Charter Co., Ford Bldg., Wilmington, Del.

THE CRANE CHEMICAL CO., Brooklyn, N. Y., has been incorporated with a capital of $100,000, to manufacture chemicals and chemical byproducts. The incoprorators are J. W. Crane and J. E. Glen. The company is represented by G. L. Robinson, 31 Nassau St., New York.

THE COLUMBIANA FOUNDRY CO., McKeesport, Pa., has been incorporated with a capital of $5,000, to manufacture iron, steel and other metal castings. F. B. McConnell, McKeesport, is treasurer.

THE KENLATEX OIL CO., Wilmington, Del., has been incorporated under state laws with capital of $500,000, to manufacture petroleum products. The company is represented by the Delaware Charter Co., 904 Market St., Wilmington.

THE UNITED STATES PRODUCTS CORP., Wilmington, Del., has been incorporated with a capital of $125,000, to manufacture chemicals and chemical byproducts. The company is represented by the Colonial Charter Co., Ford Bldg., Wilmington.

Capital Increases, Etc.

THE PENNSYLVANIA POTASH ACID FERTILIZER CO., Westfield, Pa., has filed notice of increase in capital from $350,000 to $1,000,000.

THE GEORGIA FULLERS EARTH CO., 26 Cortlandt St., New York, N. Y., has filed notice of increase in capital from $400,000 to $1,000,000.

THE WHITAKER-GLESSNER CO., Wheeling, W. Va., manufacturer of steel products, has disposed of a bond issue of $4,500,000, the proceeds to be used for general financing, operations and expansion.

THE GENERAL PETROLEUM PRODUCTS CO., 94th and Tinicum Sts., Philadelphia, Pa., has filed notice of increase in capital from $150,000 to $750,000.

THE RECTOR CHEMICAL CO., INC., 2 Rector St., New York, N. Y., has filed notice of dissolution under state laws.

THE LA BELLE IRON WORKS, Steubenville, O., manufacturer of steel slabs, billets, sheets, etc., has disposed of a bond issue of $4,000,000, the proceeds to be used for general financing and operations.

THE MOODY OIL & REFINING CO., Wichita Falls, Tex., has filed notice of increase in capital from $5,000,000 to $21,500,000.

THE POCOT OIL CO., Tonawanda, N. Y., has filed notice of increase in capital from $10,000 to $100,000.

Industrial Developments

PAPER—The Hinde & Dauch Paper Co., Sandusky, O., has resumed operations at its mill at Muncie, Ind., which has been closed for about a year past. The working force will be increased as rapidly as the plant can be placed in condition for operation.

Practically all of the paper mills in the New England district are increasing operations and adding to the working forces.

The Spanish River Pulp & Paper Mills, Ltd., Montreal, Que., is advancing its working schedule and is now operating at close to capacity.

The International Paper Co., New York, N. Y., has commenced the manufacture of paper at its new mill at Three Rivers, Que., which previously has been operating in part for the production of sulphite pulp. The plant has a rated capacity of 96 tons of paper daily, and it is expected to develop this maximum in the near future.

All of the paper mills at Escanaba, Mich., have resumed operations both in the pulp and paper divisions, following an idleness of a number of months. About 400 men have been added to the working forces.

RUBBER—The Firestone Tire & Rubber Co., Akron, O., has advanced its production schedule to a basis of 20,000 tires a day, as compared with an output of 17,000 tires daily in recent weeks.

The Seiberling Tire & Rubber Co., with plants at Barberton, O., and New Castle, Pa., has increased operations to a point of 1,600 tires and 2,000 tubes per day. Additional workers will be employed in the near future.

GLASS—The Pittsburgh Plate Glass Co., Pittsburgh, Pa., has increased production at its different plants to approximately 90 per cent of normal capacity.

The Ball Bros. Glass Mfg. Co., Muncie, Ind., is giving employment to about 1,500 operatives at its plant, and plans for increased operations, with additional workers, at an early date.

CERAMIC—The Enduro Porcelain Enameling Co. Middletown, Pa., a subsidiary of the Wincroft Stove Works, is maintaining full capacity operations at its plant, and has adopted a day and night working schedule.

The National Fireproofing Co., Perth Amboy, N. J., is increasing production at its local plant and adding to the working force. The present schedule is close to capacity output, with 10-hour working day.

METALS—The Anaconda Copper Mining Co., Butte, Mont., is increasing production at its local plants, with employment of an increased working force. The Washoe smelter at Anaconda, Mont., and the Great Falls, Mont., plants are in active operation.

The Utah-Apex Mining Co., Bingham, Utah, has resumed operations at its local properties, following a suspension for more than a year past. Employment will be given to about 250 men, with output of about 450 tons of lead ore per day.

Practically all of the metal-refining plants at Perth Amboy, N. J., have increased the April production schedule, as compared with the February and March outputs, and a large number of additional men are be-

ing employed. The different plants include the American Smelting & Refining Co., the United Lead Co. and the Raritan Copper Works.

A number of copper compaines in the vicinity of Ray, Ariz., have resumed operations at their properties, following a shut-down for about a year past. The principal companies, under one management, include the Utah Copper Co., the Ray Consolidated Copper Co., and Chino Copper Co. and the Nevada Copper Co. The present basis of production will be increased gradually.

The Calumet & Hecla Copper Co., Calumet, Mich., has resumed operations at its plant. Other copper companies in this same section are re-opening, including the Isle Royale Copper Co., and the Ahmeek Copper Co., giving employment to a total of about 2,000 men.

IRON AND STEEL—The Monongahela Tube Co., Clairton, Pa., is arranging for the immediate operation of its No. 2 furnace on day and night shifts, giving employment to about 175 men. The plant has been idle since late last year.

The Canton Sheet Steel Co., Canton, O., has resumed operations at its plant, effective April 17, following a shut-down for some time past.

The Tennessee Coal, Iron & Railroad Co., Birmingham, Ala., is operating its Ensley steel works at full capacity, and broke all previous production records during March, with the ingot mill manufacturing 96,000 tons, and the blooming mill 75,000 tons. One of the blast furnaces at the plant is being repaired and will be placed in service at an early date.

The Otis Steel Co., Cleveland, O., has opened its new sheet mill, and will soon bring the plant up to capacity. Present production is on a 75 per cent basis.

The Republic Iron & Steel Co., Youngstown, O., has blown in another blast furnace at its Hazleton plant, making the third unit in operation.

The Central Steel Co., Massillon, O., is increasing production at its mills, and six of the nine furnaces are now in operation. Further inerease will be made at an early date.

The Sharon Steel Hoop Co., Sharon, Pa., is making ready to blow in its blast furnace at Lowellville, Ohio.

Manufacturers' Catalogs

THE L. R. CHRISTIE Co., Pittsburgh, Pa., has recently issued a new catalog showing various types of driers and containing two interesting articles by L. R. Christie, one on "Dryer Engineering" and the other on "Dryer Efficiency," which are illustrated by curves of some value to the engineer.

CHARLES ENGELHARD, INC., New York, is issuing Bull. A-23 on "Impervite Hard Porcelain and Impervite Refractory Porcelain."

THE SHEPARD ART METAL Co., Detroit, Mich., announces the publication of a booklet on "Shepard Die Castings." In it there is a chapter about die castings, illustrations and description of closed body hardware, polished nickel finish; die castings in zinc base alloys; die castings in aluminum; die castings in tin base metals, and die castings in lead alloys.

THE GRISCOM-RUSSELL Co., New York, in Bull. 360 describes "Griscom-Russell Evaporator Systems for the Economical Production of Distilled Boiler Feed Water." The application of evaporators to the purification of boiler feed water by distillation is covered in a general and non-technical way. The booklet is written so that the application of Reilly evaporators can readily be understood by the non-technical executive as well as the engineer.

THE ESTERLINE-ANGUS Co., Indianapolis, Ind., in Bull. 322 illustrates and describes various types of its graphic meter.

THE ATLAS VALVE Co., Newark, N. J., has issued a booklet on "Reducing Valves," giving tables and rules for determining the capacity of reducing valves and pipe connections; also for determining the capacity and flow of steam in pipes of different diameters and different losses in pressure. Copies will be sent upon request.

THE UEHLING INSTRUMENT Co., Paterson, N. J., calls attention to Bull. 112, covering Uehling CO_2 recording equipment for guiding the engineer and fireman in reducing the waste of fuel up the chimney. Particular attention is called to the recently developed "Pyro-porus" filter, shown on page 10, an exclusive Uehling feature, which is claimed to be very efficient in keeping the gas sampling lines clean. Other noteworthy features are the separate recorder for the engineer's office and indicator for the boiler front continuous (not intermittent) chart record and dry method of absorption.

W. S. ROCKWELL Co., 50 Church St., New York, has issued Bulletin 240, on "The Heat-Treatment of Springs With Stationary and Continuous Furnaces." This is one of a series of well-written pamphlets outlining the many factors controlling the methods of applying and utilizing heat and handling material in the modern metallurgical plant.

MERCK & Co., New York, are distributing a new edition of their booklet "Blue Label Reagents and Other Laboratory Chemicals." Copies will be sent to anyone interested on request.

THE DENVER FIRE CLAY Co., Denver, Col., has published an attractive bulletin on Oil Burners. This company is endeavoring to carry out an educational campaign in all its bulletins, making them useful for something besides the selling of its products, and in this bulletin the first twenty-one pages are devoted exclusively to the general discussion on various methods of using oil as fuel, while the last twelve pages are devoted to illustrations and descriptions of low-pressure burners, high-pressure burners, the combination burner, the high-low burner, the motorblower, blast valve, tuyere, refractories and illustrations for furnaces using DFC burners.

THE COMBUSTION ENGINEERING CORP., Broad St., New York, calls attention to a folder on Type K automatic stoker for small plants, and a booklet on the application of pulverized coal to locomotives. This latter booklet entitled "Lopulco Pulverized Fuel System for Locomotives," tells of the interesting phases of this company's pioneer work and contains a number of informative test reports.

WALLACE & TIERNAN Co., INC., of Newark, N. J., has just issued a new technical publication, No. 30, describing its bacteriological testing outfit and other chemical testing outfits useful in the control of water purification.

THE PYROLECTRIC INSTRUMENT Co., Trenton N. J., announces the publication of Catalog 19. It contains this company's complete line, including apparatus for low-resistance measurements, electro-dynamometer, electrometers, furnaces, galvanometers, hydrogen-ion apparatus and chemicals, inductances, keys and switches, laboratory accessories, meters for d.c. measurements, pyrometers and thermocouples, pyrovolter type instruments, resistances and resistance thermometers. Illustrations are given.

THE HOYT METAL Co., St. Louis, Mo., has issued a booklet on Products of Rolling Mill and Pipe Departments.

THE NATIONAL CARBON Co., INC., New York City, has just issued "The Carbon Electrode," an 80-page booklet containing many scientific and engineering data relating to the manufacture and use of electrodes in electric furnaces. The booklet contains also some useful hints on the handling, joining and storage of electrodes, as well as some useful electrode "don'ts."

THE SURFACE COMBUSTION Co., New York, N. Y., has ready for distribution Bulletin 3D on Surface Combustion Low-Pressure Air-Gas Inspirators. These inspirators are designed so as to be readily applicable to any make of gas furnace.

THE STANDARD CALORIMETER Co., East Moline, Ill., calls attention to Booklet 102, on "Directions for Using the Parr Sulphur Bombs and the Parr Sulphur Photometer."

SCHUTTE & KOERTING, Philadelphia, Pa., has just issued a new bulletin on "Air Jet Lift Equipment." This booklet is well illustrated, showing the action of the air jet lift, also several applications. Formulas and tables are given showing capacities under various conditions of air pressure handling different liquids.

THE HARDINGE Co., New York, N. Y., calls attention to a new bulletin on Quigley Fuel Systems, comprising methods of preparing, transporting and burning of pulverized fuels. This bulletin is known as No. 12 and treats the subject of pulverized fuels. Emphasis is laid upon the methods employed properly to prepare and burn the powdered coal, rather than occupying most of the space discussing the pulverizer. Aside from complete plant layouts, what it terms as a "Unit Milling Plant" is described. The system comprises a method of pulverizing and transporting the coal to one or more furnaces in the same locality, at the same time obtaining positive regulation and continuous operation over extended periods. A partial list of users is given.

THE PHILADELPHIA COPPERSMITHING Co., Philadelphia, Pa., has issued Catalog "S," descriptive of its sugar equipment. It announces that its research laboratories are in charge of Dr. Henry Arnstein and that it is equipped to handle problems dealing with chemicals (organic or inorganic), dyes, pharmaceuticals, food and food substitutes, sugar, motor fuel from vegetable and residual sources, vegetable oil, soap, glycerine, etc., plants.

THE CENTURY WOOD PRESERVING Co., Pittsburgh, Pa., in Bulletin 20 describes the storing and seasoning of cross-ties.

Coming Meetings and Events

AMERICAN ASSOCIATION OF ENGINEERS will hold its eighth annual convention at Salt Lake City, Utah, June 4-6.

AMERICAN ELECTROCHEMICAL SOCIETY will hold its spring meeting in Baltimore, April 27, 28 and 29, 1922. Headquarters will be at the Emerson Hotel.

AMERICAN FOUNDRYMEN'S ASSOCIATION will hold its next convention and exhibit at Rochester, N. Y., during the week of June 5, 1922. Meetings will be held in the spring instead of in the fall as heretofore.

AMERICAN INSTITUTE OF CHEMICAL ENGINEERS will hold its summer meeting at Niagara Falls, Canada, June 19 to 22. Headquarters will be at the Clifton Hotel.

AMERICAN LEATHER CHEMISTS ASSOCIATION will hold its nineteenth annual meeting at Bigwin Inn, Bigwin Island, in the Lake of Bays district, Ontario, Canada, on June 21, 22 and 23.

AMERICAN OIL CHEMISTS' SOCIETY will hold its annual meeting at the Grunewald Hotel, New Orleans, La., May 8 and 9.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS will hold its spring meeting at Atlanta, Ga., May 8-11.

AMERICAN SOCIETY FOR STEEL TREATING will hold a sectional meeting at the Bureau of Mines auditorium, Pittsburgh, Pa., on May 25 and 26. The International Steel Exposition and Convention of the society will be held in the General Motors Bldg., Detroit, Mich., Oct. 2 to 7.

AMERICAN SOCIETY FOR TESTING MATERIALS will hold its twenty-fifth annual meeting June 26 to July 1, at Atlantic City, N. J. Headquarters will be at the Chalfonte-Haddon Hall Hotel.

AMERICAN WELDING SOCIETY will hold its annual meeting April 26-29 at the Engineering Societies Building, New York City.

ANNUAL SAFETY CONGRESS of the NATIONAL SAFETY COUNCIL will be held in Detroit, Mich., Aug. 28-Sept. 2.

CANADIAN INSTITUTE OF CHEMISTRY and the SOCIETY OF CHEMICAL INDUSTRY will hold their annual meetings in Ottawa May 15-17.

CERAMIC SOCIETY (London) is to have a foreign trip to Sweden and Denmark from May 27 to June 10.

INTERNATIONAL UNION OF PURE AND APPLIED CHEMISTRY will hold a meeting at Lyons, France, June 27 to 30.

IRON AND STEEL INSTITUTE (British) will hold its annual meeting on May 4 and 5 at the House of the Institution of Civil Engineers, Great George St., S. W., 1, London.

NATIONAL ASSOCIATION OF PURCHASING AGENTS EXPOSITION (the "Informashow") will be held in connection with the seventh annual convention of the association at Exposition Park, Rochester, N. Y., May 15 to 22.

NATIONAL COAL ASSOCIATION will hold its annual meeting at Congress Hall, Chicago, May 24-25.

NATIONAL EXPOSITION OF CHEMICAL INDUSTRIES (EIGHTH) will be held in New York Sept. 11-16.

NATIONAL EXPOSITION OF POWER AND MECHANICAL ENGINEERING will be held at the Grand Central Palace Dec. 7-13, with the exception of the intervening Sunday.

NATIONAL FERTILIZER ASSOCIATION will hold its twenty-ninth annual convention at the Greenbrier, White Sulphur Springs, W. Va., the week of June 12.

NEW JERSEY CHEMICAL SOCIETY will meet at Stetters Restaurant, 842 Broad St., Newark, N. J., the second Monday of every month.

SOCIETY OF INDUSTRIAL ENGINEERS will hold its national convention in Detroit, Mich., April 26-28.

STAMFORD CHEMICAL SOCIETY, Stamford, Conn., holds a meeting in the lecture room of the local high school on the fourth Monday of each month, except June, July, August and September.

The following meetings are scheduled to be held in Rumford Hall, the Chemists Club, New York: April 21—Society of Chemical Industry (in charge), American Electrochemical Society, Société de Chimie Industrielle, American Chemical Society, joint meeting; May 5—American Chemical Society, regular meeting; May 12—Société de Chimie Industrielle (in charge), American Chemical Society, Society of Chemical Industry, American Electrochemical Society, joint meeting; May 19—Society of Chemical Industry, regular meeting: June 9—American Chemical Society, regular meeting.